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REPORT OF

# THE INTERNATIONAL COMMITTEE

## ON ATOMIC WEIGHTS.

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IN the year 1900 an International Committee on atomic weights was organized, composed of more than fifty representatives from chemical and other societies. Its conferences were necessarily conducted by correspondence, and the delays and difficulties of the work proved to be both serious and annoying. Accordingly, the Committee, by vote, designated a smaller body of three representatives, and the latter now has the honour to report its recommendations.

On the fundamental question of standards, definite and formal action seems to be impracticable. By the original committee of the German Chemical Society, the oxygen standard was adopted, but that proposal, whilst receiving strong support, also met with serious opposition. In fact, opinion, as expressed by individual voices, seems to be somewhat evenly divided upon this question, and around it there has already grown up a controversial literature of formidable proportions. To force the adoption of either standard, oxygen, or hydrogen, appears therefore to be impossible, and for some time to come both are likely to be employed. Between them, experience must be the final arbiter. That standard which best serves to co-ordinate chemical and physical knowledge will ultimately be chosen, and the other will gradually fall into disuse. Meanwhile, it is important that the most probable values for the several atomic weights should be indicated, and that every table of them should be consistent within itself. Such a table has been prepared by our distinguished predecessors and its revision, as knowledge advances, seems to be our proper function.

In order that our work may be of the most general service, we have prepared a table in which both standards of atomic weight are represented. In most of its details it is identical with the table which was reported by the previous committee at the beginning of the year 1902.\* Some changes, however, have, in our judgment, become necessary, and these may be briefly indicated as follows:

**Antimony.**—In the former reports of the committee, the value derived by Cooke from analyses of the bromide,  $Sb = 120$ , was adopted.

\* In No. 1 of the *Berichte* for 1902.

This, however, ignores the work of Cooke and of Schneider upon antimony trisulphide, and the still more recent determinations made by Friend and Smith. The true number being therefore in doubt, we recommend the use of an average value, and put  $Sb = 120.2$ .\*

**Germanium.**—The number 72.5 is more nearly in accord with Winkler's determinations than the former number 72.

**Hydrogen.**—In the column which represents the oxygen standard, hydrogen has heretofore been assigned the value 1.01. The number 1.008 is, however, much more exact, and the error in 1.01 is too large to be perpetuated. Each figure should be given to the nearest *significant* decimal.

**Lanthanum.**—During 1902, two new determinations of the atomic weight of lanthanum were published. According to Jones,  $La = 138.77$ . Brauner and Pavliček found  $La = 139.04$ . Both investigations were conducted with great skill and care, and each one seems to have some points of advantage over the other. The average  $La = 138.9$  appears to be the safest value to adopt. These data naturally influence our judgment in the case of cerium, and we retain Brauner's number,  $Ce = 140$ , rather than adopt the lower estimates made by other observers.

**Mercury.**—Taking into account all the determinations which have appeared, and giving great weight to the most recent measurements by Hardin, we regard the value  $Hg = 200$  as best warranted by the existing evidence.

**Palladium.**—The atomic weight of this metal is in doubt. The best determinations give values ranging from 106 to 107. The mean between them,  $Pd = 106.5$ , has been provisionally adopted.

**Radium.**—This element appears in the table for the first time. Madame Curie's determination of the atomic weight,  $Ra = 225$ , is probably not far from the truth.

**Selenium.**—Judging from the work of Lenher, and the very recent determinations by Jul. Meyer, the former value,  $Se = 79.1$ , is probably too low. In order to give due weight to the newer measurements, we write  $Se = 79.2$ .

**Tin.**—The determinations by Bongartz and Classen, which seem to be the best, make  $Sn = 119$ . The former value, 118.5, is almost certainly too low.

**Uranium.**—According to the very recent investigation by Richards and Merigold, the atomic weight of uranium is 238.5.

**Zirconium.**—The figure  $Zr = 90.6$  is apparently the most probable.

In thus assuming the duties assigned to us by the larger International Committee, we act upon the conviction that the purpose of our appointment is to secure the promptness and efficiency which is only possible with a comparatively small working body. In order to carry out this purpose, we must depend upon the co-operation and assistance of our colleagues. We therefore beg that they, and also all other chemists who are interested in researches upon atomic weights, will aid us with their criticisms and advice. We especially ask that

\*  $O = 16$ .

publications upon the subject shall be sent to us, in triplicate if possible, so that no matter of importance may be overlooked. Without support of this kind our work cannot be made fully effective.

The complete table of atomic weights, with foregoing changes incorporated, follows.

F. W. CLARKE }  
T. E. THORPE } *Committee.*  
KARL SEUBERT }

1903.

# INTERNATIONAL ATOMIC WEIGHTS.

				O=16.	H=1.
Aluminium ...	...	Al ...	...	27·1 ...	26·9
Antimony ...	...	Sb ...	...	120·2 ...	119·3
Argon...	...	A ...	...	39·9 ...	39·6
Arsenic ..	...	As ...	...	75·0 ...	74·4
Barium ...	...	Ba ...	...	137·4 ...	136·4
Bismuth ...	...	Bi ...	...	208·5 ...	206·9
Boron ...	...	B ...	...	11 ...	10·9
Bromine ...	...	Br ...	...	79·96 ...	78·36
Cadmium ...	...	Cd ...	...	112·4 ...	111·6
Cæsium ...	...	Cs ...	...	133 ...	132
Calcium ...	...	Ca ...	...	40·1 ...	39·8
Carbon ...	...	C ...	...	12·00 ...	11·91
Cerium ...	...	Ce ...	...	140 ...	139
Chlorine ...	...	Cl ...	...	35·45 ...	35·18
Chromium ...	...	Cr ...	...	52·1 ...	51·7
Cobalt ...	...	Co ...	...	59·0 ...	58·56
Columbium (Niobium)	...	Cb ...	...	94 ...	93·3
Copper ...	...	Cu ...	...	63·6 ...	63·1
Erbium ...	...	E ...	...	166 ...	164·8
Fluorine ...	...	F ...	...	19 ...	18·9
Gadolinium ...	...	Gd ...	...	156 ...	155
Gallium ...	...	Ga ...	...	70 ...	69·5
Germanium ...	...	Ge ...	...	72·5 ...	71·9
Glucinum (Beryllium)	...	Gl ...	...	9·1 ...	9·03
Gold ...	...	Au ...	...	197·2 ...	195·7
Helium ...	...	He ...	...	4 ...	4
Hydrogen ...	...	H ...	...	1·008 ...	1·000
Indium ...	...	ln ...	...	111 ...	113·1
Iodine ...	...	I ...	...	126·85 ...	125·90
Iridium ...	...	Ir ...	...	193·0 ...	191·5
Iron ...	...	Fe ...	...	55·9 ...	55·5
Krypton ...	...	Kr ...	...	81·8 ...	81·2
Lanthanum ...	...	La ...	...	138·9 ...	137·9
Lead ...	...	Pb ...	...	206·9 ...	205·35
Lithium ...	...	Li ...	...	7·03 ...	6·98
Magnesium ...	...	Mg ...	...	24·36 ...	24·18
Manganese ...	...	Mn ...	...	55·0 ...	54·6
Mercury ...	...	Hg ...	...	200·0 ...	198·5

\*

			O = 16.	H = 1.
Molybdenum...	Mo ...	...	96·0 ...	95·3
Neodymium ...	Nd ...	...	143·6 ...	142·5
Neon ...	Ne ...	...	20 ...	19·9
Nickel ...	Ni ...	...	58·7 ...	58·3
Nitrogen ...	N ...	...	14·04 ...	13·93
Osmium ...	Os ...	...	191 ...	189·6
Oxygen ...	O ...	...	16·00 ...	15·88
Palladium ...	Pd ...	...	106·5 ...	105·7
Phosphorus ...	P ...	...	31·0 ...	30·77
Platinum ...	Pt ...	...	194·8 ...	193·3
Potassium ...	K ...	...	39·15 ...	38·86
Praseodymium ...	Pr ...	...	140·5 ...	139·4
Radium ...	Ra ...	...	225 ...	223·3
Rhodium ...	Rh ...	...	103·0 ...	102·2
Rubidium ...	Rb ...	...	85·4 ...	84·8
Ruthenium ...	Ru ...	...	101·7 ...	100·9
Samarium ...	Sm ...	...	150 ...	148·9
Scandium ...	Sc ...	...	44·1 ...	43·8
Selenium ...	Se ...	...	79·2 ...	78·6
Silicon ...	Si ...	...	28·4 ...	28·2
Silver...	Ag ...	...	107·93 ...	107·12
Sodium ...	Na ...	...	23·05 ...	22·88
Strontium ...	Sr ...	...	87·6 ...	86·94
Sulphur ...	S ...	...	32·06 ...	31·83
Tantalum ...	Ta ...	...	183 ...	181·6
Tellurium ...	Te ...	...	127·6 ...	126·6
Terbium ...	Tb ...	...	160 ...	158·8
Thallium ...	Tl ...	...	204·1 ...	202·6
Thorium ...	Th ...	...	232·5 ...	230·8
Thulium ...	Tm ...	...	171 ...	169·7
Tin ...	Su ...	...	119·0 ...	118·1
Titanium ...	Ti ...	...	48·1 ...	47·7
Tungsten ...	W ...	...	184·0 ...	182·6
Uranium ...	U ...	...	238·5 ...	236·7
Vanadium ...	V ...	...	51·2 ...	50·8
Xenon ...	X ...	...	128 ...	127
Ytterbium ...	Yb ...	...	173·0 ...	171·7
Yttrium ...	Yt ...	...	89·0 ...	88·3
Zinc ...	Zn ...	...	65·4 ...	64·9
Zirconium ...	Zr ...	...	90·6 ...	89·9

# INSTRUCTIONS TO ABSTRACTORS,

GIVING THE

## NOMENCLATURE AND SYSTEM OF NOTATION

### ADOPTED IN THE ABSTRACTS.

THE object of the abstracts of chemical papers published elsewhere than in the Transactions of the Society is to furnish the Fellows with a concise account of the progress of chemical science from month to month. It must be understood that as the abstracts are prepared for the information of the Fellows in general, they cannot possibly be made so full or so detailed as to obviate on the part of those who are engaged on special investigations the necessity of consulting the original memoirs.

1. Titles of papers must be given literally.
2. Before beginning to write the abstract, the whole of the original paper must be read, in order that a judgment may be formed of its importance and of the scale on which the abstract should be made.
3. In the case of papers dealing with subjects not strictly chemical, the abstract should refer only to matters of chemical interest in the original.
4. The abstract should consist mainly of the expression, in the abstractor's own words, of the substance of the paper.
5. The abstract should be made as short as is consistent with a clear and accurate statement of the author's results.
6. If an abstract of a paper on the same subject, either by the author of the paper abstracted, or by some other author, has already appeared, note should, as a rule, be made of this fact.
7. Matter which has appeared once in the *Abstracts* is not to be abstracted again, a reference being given to the volume in which the abstract may be found.
8. As a rule, details of methods of preparation or analysis, or generally speaking of work, are to be omitted, unless such details are essential to the understanding of the results, or have some independent value. Further, comparatively unimportant compounds, such as the inorganic salts of organic bases or acids, should be mentioned quite shortly. On the other hand, data such as melting and boiling points, sp. gr., specific rotation, &c., must be given in every case unless recorded in earlier papers.

## Nomenclature.

9. Employ names such as *sodium chloride*, *potassium sulphate* for inorganic compounds, and use the terminals *ous* and *ic* only in distinguishing compounds of different orders derived from the same elementary radicle; such, for instance, as mercurous and mercuric chlorides, sulphurous and sulphuric acids.

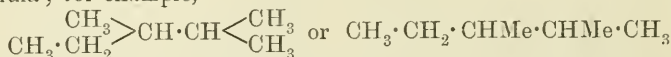
10. Term compounds of metallic radicles with the OH-group *hydroxides* and not hydrates, the name hydrate being reserved for compounds supposed to contain water of combination or crystallisation.

11. Term salts containing an amount of metal equivalent to the displaceable hydrogen of the acid, *normal* and not neutral salts, and assign names such as sodium hydrogen sulphate, disodium hydrogen phosphate, &c., to the acid salts. Basic salts as a rule are best designated merely by their *formule*.

12. Names in common use for oxides should be employed, for example: NO, nitric oxide; CO<sub>2</sub>, carbon dioxide; P<sub>4</sub>O<sub>10</sub>, phosphoric oxide; As<sub>2</sub>O<sub>3</sub>, arsenious oxide; Fe<sub>2</sub>O<sub>3</sub>, ferric oxide.

13. In open chain compounds, Greek letters must be used to indicate the position of a substituent, the letter *a* being assigned to the first carbon atom in the formula, except in the case of CN and CO<sub>2</sub>H, for example, CH<sub>3</sub>·CH<sub>2</sub>·CH<sub>2</sub>·CH<sub>2</sub>I *α*-iodobutane, CH<sub>3</sub>·CH<sub>2</sub>·CH<sub>2</sub>·CN *α*-cyanopropane.

14. Isomeric open chain compounds are most conveniently represented as substitution derivatives of the longest carbon chain in the formula; for example,



should be termed *βγ*-dimethylpentane, not methylethylisopropylmethane, and

$\text{CH}_3 \begin{array}{c} \text{CH}_3 \\ > \end{array} \text{CH} \cdot \text{CH} \begin{array}{c} \text{CH}_3 \\ < \end{array} \text{CO}_2\text{H} \text{ or } \text{CH}_3 \cdot \text{CHMe} \cdot \text{CHMe} \cdot \text{CO}_2\text{H}$   
should be termed *αβ*-dimethylbutyric acid, not *αββ*-trimethylpropionic, or *α*-methylisovaleric, or methylisopropylacetic acid.

15. Use names such as methane, ethane, &c., for the normal paraffins or hydrocarbons of the C<sub>n</sub>H<sub>2n+2</sub> series of the form CH<sub>3</sub>·[CH<sub>2</sub>]<sub>5</sub>·CH<sub>3</sub>, &c. Term the hydrocarbons C<sub>2</sub>H<sub>4</sub> and C<sub>2</sub>H<sub>2</sub> ethylene and acetylene respectively (not ethene and ethine). Homologues of the ethylene series are to be indicated by the suffix *-ene*, and those of the acetylene series, wherever possible, by *-ine*. Adopt the name allene for the hydrocarbon CH<sub>2</sub>:C:CH<sub>2</sub>.

16. Distinguish all hydroxyl derivatives of hydrocarbons by names ending in *ol*. Alcohols should be spoken of as mono-, di-, tri-, or n-hydric, according to the number of OH-groups. Compounds which are not alcohols, but for which names ending in *ol* have been used, are to be represented by names ending in *ole*, if a systematic name cannot be given, thus anisole not anisoil, indole not indol. Compounds such as MeONa, EtONa, &c., should be termed sodium methoxide, sodium ethoxide, &c.

17. The radicles indicated in the name of a compound are to be



given in the order fluoro-, chloro-, bromo-, iodo-, nitro-, nitroso-, amino-, imino-, cyano-, thiocyno-, hydroxy-, keto-.

18. Compounds analogous to the acids of the lactic series containing the OH-group should be termed *hydroxy*-derivatives, and not oxy-derivatives; for example, hydroxyacetic and not oxyacetic acid. Compounds containing the analogous groups OEt, OPh, OAc, &c., should in like manner be termed ethoxy-, phenoxy-, acetoxy- derivatives. Thus  $\alpha$ -ethoxypropionic acid,  $\text{OEt} \cdot \text{CHMe} \cdot \text{CO}_2\text{H}$ , instead of ethyl-lactic acid; 3:4-diethoxybenzoic acid,  $(\text{OEt})_2\text{C}_6\text{H}_3 \cdot \text{CO}_2\text{H}$ , instead of diethylprotocatechuic acid; and  $\alpha$ -acetoxypropionic acid,  $\text{OAc} \cdot \text{CHMe} \cdot \text{CO}_2\text{H}$ , instead of acetyl-lactic acid. Terms such as diethylprotocatechuic acid should be understood to mean a compound formed by the displacement of hydrogen atoms in the hydrocarbon radicle of protocatechuic acid by ethyl, viz.,  $\text{C}_6\text{H}(\text{Et})_2(\text{OH})_2 \cdot \text{CO}_2\text{H}$ , and not  $\text{C}_6\text{H}_3(\text{OEt})_2 \cdot \text{CO}_2\text{H}$ , just as dibromoprotocatechuic acid is understood to be the name of a compound of the formula  $\text{C}_6\text{HBr}_2(\text{OH})_2 \cdot \text{CO}_2\text{H}$ .

19. The term *ether* should be restricted to the oxides of hydrocarbon radicles and their derivatives, and the esters (so-called compound ethers or ethereal salts) should be represented by names similar to those given to metallic salts.

20. When a substituent is one of the groups  $\text{NH}_2$ ,  $\text{NHR}$ ,  $\text{NR}_2$ ,  $\text{NH}$  or  $\text{NR}$ , its name should end in *ino*; for example,  $\beta$ -aminopropionic acid,  $\text{NH}_2 \cdot \text{CH}_2 \cdot \text{CH}_2 \cdot \text{CO}_2\text{H}$ ,  $\beta$ -anilino-acrylic acid,  $\text{NHPh} \cdot \text{CH} \cdot \text{CH} \cdot \text{CO}_2\text{H}$ ,  $\alpha$ -iminopropionic acid,  $\text{NH} \cdot \text{CMe} \cdot \text{CO}_2\text{H}$ .

21. Compounds of the radicle  $\text{SO}_3\text{H}$  should, whenever possible, be termed sulphonic acids, or failing this, sulpho-compounds; for example, benzenesulphonic acid, sulphobenzoic acid.

22. Basic substances should invariably be indicated by names ending in *ine*, as aniline instead of anilin, the termination *in* being restricted to certain neutral compounds, viz., glycerides, glucosides, bitter principles, and proteids, such as palmitin, amygdalin, albumin. The compounds of basic substances with hydrogen chloride, bromide or iodide should always receive names ending in *ide* and not *ate*, as morphine hydrochloride and not morphine hydrochlorate.

23. The Collective Index, 2nd decade (1883—1892) should be adopted as the standard of reference on questions of nomenclature not provided for in the preceding sections.

### Notation.

24. In empirical formulæ the elements are to be given in the order C, H, O, N, Cl, Br, I, F, S, P, and the remainder alphabetically.

25. Equations should be omitted unless essential to the understanding of the results; as a rule, they should not be written on a separate line, but should "run on" with the text.

26. To economise space, it is desirable:

- (a) That *dots* should be used instead of *dashes* in connecting contiguous symbols or radicles, whenever this does not interfere with the clearness of the formula.

(b) That formulæ should be shortened by the judicious employment of the symbols Me for  $\text{CH}_3$ , Et for  $\text{C}_2\text{H}_5$ , Pr<sup>α</sup> for  $\text{CH}_2\cdot\text{CH}_2\cdot\text{CH}_3$ , Pr<sup>β</sup> for  $\text{CH}(\text{CH}_3)_2$ , Ph for  $\text{C}_6\text{H}_5$ , Py for  $\text{C}_5\text{H}_4\text{N}$ , Ac for  $\text{CO}\cdot\text{CH}_3$ , and Bz for  $\text{CO}\cdot\text{C}_6\text{H}_5$ .

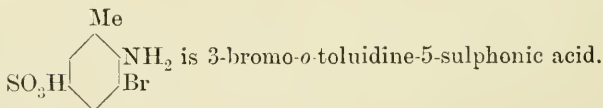
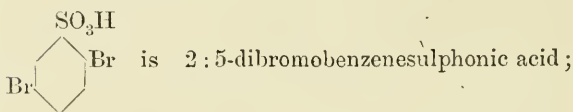
(c) That formulæ should be written *in one line* whenever this can be done without obscuring their meaning.

27. In representing the constitution of benzene derivatives, the relative positions of the radicles in the symbol of benzene should be indicated by numerals, instead of by means of the hexagon formula.

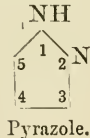
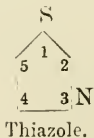
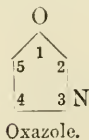
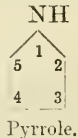
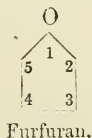
(a) The abbreviations *o*-, *m*-, and *p*-, should be used in place of 1 : 2- or ortho-, 1 : 3- or meta-, and 1 : 4- or para.

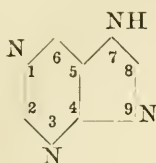
(b) In numbering positions in the case of substitution derivatives of phenol, aniline, benzonitrile, benzoic acid, benzenesulphonic acid, benzaldehyde, and toluene, the characteristic radicle of each of these parent substances is to be regarded as in position 1 (compare Collective Index).

(c) Names of substitution derivatives should be given in such a way that the position of the substituent is indicated by a numeral prefixed ; for example :—

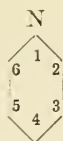


28. In representing the constitution of derivatives of other "closed chain" hydrocarbons, graphic formulæ should not be employed, but the system of numbering positions indicated in Richter's *Lexikon der Kohlenstoff-Verbindungen* (2nd edition, 1899, pp. 16—26) should be used, of which the following schemes may be regarded as typical :—





Purine.\*



Pyridine.



Indole.



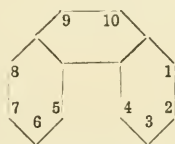
Naphthalene.



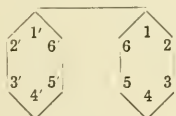
Quinoline.

*iso*Quinoline.

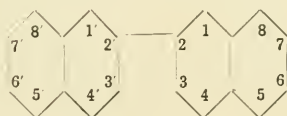
Anthracene.



Phenanthrene.



Diphenyl.

 $\beta\beta$  Dinaphthyl.

### Manuscript.

29. In view of the difficulty of dealing with MSS. of widely varying sizes, abstracts cannot be accepted unless written on quarto paper (10  $\times$  8 in.).

30. Not more than one abstract must appear on a sheet.

31. When an abstract exceeds a sheet in length, the sheets must be fastened together by means of gum at the top left-hand corner.

32. The name of the abstractor must be written diagonally at the top left-hand corner of the first sheet of the abstract.

### Proofs.

33. Abstractors are expected to read and correct proofs carefully, and to check all formulæ and figures against MSS.

34. All proofs, however small, must be returned to the Sub-Editor not later than 24 hours after receipt from the printers.

\* \* \* The Editor's decision, in all matters connected with the Abstracts, must be considered final.

\* This numbering, proposed originally by E. Fischer, is adopted in the text of the *Lexikon*.

## JOURNALS FROM WHICH ABSTRACTS ARE MADE.

All references to Journals should give the abbreviated title, the year of publication, the series, the volume and the page; thus *Ber.* 1901, 34, 2455; *Bull. Soc. chim.* 1901, [iii], 25, 791; *Gazetta* 1901, 31, i, 554.

ABBREVIATED TITLE.	JOURNAL.
<i>Amer. Chem. J.</i> . . .	American Chemical Journal.
<i>Amer. J. Pharm.</i> . . .	American Journal of Pharmacy.
<i>Amer. J. Sci.</i> . . .	American Journal of Science.
<i>Analyst</i> . . .	The Analyst.
<i>Annalen</i> . . .	Justus Liebig's Annalen der Chemie.
<i>Ann. Physik</i> . . .	Annalen der Physik.
<i>Ann. Agron.</i> . . .	Annales agronomiques.
<i>Ann. Chim. anal.</i> . . .	Annales de Chimie analytique appliquée à l'Industrie, à l'Agriculture, à la Pharmacie et à la Biologie.
<i>Ann. Chim. Phys.</i> . . .	Annales de Chimie et de Physique.
<i>Ann. Inst. Pasteur</i> . . .	Annales de l'Institut Pasteur.
<i>Ann. sci. Univ. Jassy</i> . . .	Annales scientifiques de l'Université de Jassy.
<i>Arch. Hygiene</i> . . .	Archiv für Hygiene.
<i>Arch. Néerland.</i> . . .	Archives Néerlandaises des sciences exactes et naturelles.
<i>Arch. Pharm.</i> . . .	Archiv der Pharmazie.
<i>Arch. Sci. phys. nat.</i> . . .	Archives des Sciences physiques et naturelles.
<i>Atti R. Accad. Sci. Torino.</i> . . .	Atti della Reale Accademia delle Scienze di Torino.
<i>Atti R. Accad. Lincei</i> . . .	Atti della Reale Accademia dei Lincei.
<i>Beitr. chem. Physiol. Path.</i> . . .	Beiträge für chemische Physiologie und Pathologie.
<i>Ber.</i> . . .	Berichte der Deutschen chemischen Gesellschaft.
* <i>Bied. Centr.</i> . . .	Biedermann's Centralblatt für Agrikulturchemie und rationellen Landwirtschafts-Betrieb.
<i>Bihang K. Svenska Vet.-Akad. Handl.</i> . . .	Bihang till Kongl. Svenska Vetenskaps-Akademiens Handlingar.
<i>Bull. Acad. roy. Belg.</i> . . .	Académie royale de Belgique—Bulletin de la Classe des Sciences.
<i>Bull. Acad. Sci. Cracow</i> . . .	Bulletin international de l'Académie des Sciences de Cracovie.
<i>Bull. Coll. Agr. Tōkyō</i> . . .	Bulletin of the College of Agriculture, Imperial University, Tōkyō.
<i>Bull. Geol. Soc. Amer.</i> . . .	Bulletin of the Geological Society of America.
<i>Bull. Soc. chim.</i> . . .	Bulletin de la Société chimique de Paris.
<i>Bull. Soc. franç. Min.</i> . . .	Bulletin de la Société française de Minéralogie.
<i>Bull. Soc. ind. Mulhouse</i> . . .	Bulletin de la Société industrielle de Mulhouse.
<i>Centr. Bakt. Par.</i> . . .	Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten.
<i>Centr. Min.</i> . . .	Centralblatt für Mineralogie, Geologie und Palaeontologie.
* <i>Chem. Centr.</i> . . .	Chemisches Centralblatt.
<i>Chem. News</i> . . .	Chemical News.

\* Abstracts from the *Centralblatt* are made only in the case of papers published in journals other than those included in this list.

# JOURNALS FROM WHICH ABSTRACTS ARE MADE.

ABBREVIATED TITLE.	JOURNAL.
<i>Chem. Rev. Fett Harz Ind.</i>	Chemische Revue über die Fett- und Harz-Industrie.
<i>Chem. Zeit.</i>	Chemiker Zeitung.
<i>Compt. rend.</i>	Comptes rendus hebdomadaires des Séances de l'Académie des Sciences.
<i>Compt. rend. Soc. Biol.</i>	Comptes rendus des Séances de la Société de Biologie.
<i>Exper. Stat. Record</i>	Experiment Station Record.
<i>Gazzetta</i>	Gazzetta chimica italiana.
<i>Geol. Mag.</i>	Geological Magazine.
<i>Jahrb. Min.</i>	Neues Jahrbuch für Mineralogie, Geologie und Palaeontologie.
<i>Jahrb. Min. Beil.-Bd.</i>	Neues Jahrbuch für Mineralogie, Geologie und Palaeontologie. Beilage-Band.
<i>J. Amer. Chem. Soc.</i>	Journal of the American Chemical Society.
<i>J. Fed. Inst. Brewing.</i>	Journal of the Federated Institutes of Brewing.
<i>J. Geol.</i>	Journal of Geology.
<i>J. Hygiene</i>	Journal of Hygiene.
<i>J. Landw.</i>	Journal für Landwirtschaft.
<i>J. Med. Research</i>	Journal of Medical Research.
<i>J. Path. Bact.</i>	Journal of Pathology and Bacteriology.
<i>J. Pharm. Chim.</i>	Journal de Pharmacie et de Chimie.
<i>J. Physical Chem.</i>	Journal of Physical Chemistry.
<i>J. Physiol.</i>	Journal of Physiology.
<i>J. Physique</i>	Journal de Physique.
<i>J. pr. Chem.</i>	Journal für praktische Chemie.
<i>J. Roy. Agric. Soc.</i>	Journal of the Royal Agricultural Society.
<i>J. Roy. Soc. New South Wales.</i>	Journal of the Royal Society of New South Wales.
<i>J. Russ. Phys. Chem. Soc.</i>	Journal of the Physical and Chemical Society of Russia.
<i>J. Soc. Chem. Ind.</i>	Journal of the Society of Chemical Industry.
<i>Landw. Versuchs-Stat.</i>	Die landwirtschaftlichen Versuchs-Stationen.
<i>L'Orosi</i>	L'Orosi.
<i>Mem. Accad. Sci. Torino</i>	Memorie della Reale Accademia delle Scienze di Torino.
<i>Mem. Manchester Phil. Soc.</i>	Memoirs and Proceedings of the Manchester Literary and Philosophical Society.
<i>Milch Zeit.</i>	Milch Zeitung.
<i>Min. Mag.</i>	Mineralogical Magazine and Journal of the Mineralogical Society.
<i>Monatsh.</i>	Monatshefte für Chemie und verwandte Theile anderer Wissenschaften.
<i>Nuovo Cim.</i>	Il Nuovo Cimento.
<i>Öfver K. Vet.-Akad. Förh.</i>	Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar.
<i>Pflüger's Archiv.</i>	Archiv für die gesammte Physiologie des Menschen und der Thiere.
<i>Pharm. Arch.</i>	Pharmaceutical Archives.
<i>Pharm. J.</i>	Pharmaceutical Journal.
<i>Pharm. Rev.</i>	Pharmaceutical Review.
<i>Phil. Mag.</i>	Philosophical Magazine (The London, Edinburgh and Dublin).
<i>Phil. Trans.</i>	Philosophical Transactions of the Royal Society of London.
<i>Proc. Amer. Physiol. Soc.</i>	Proceedings of the American Physiological Society.
<i>Proc. Camb. Phil. Soc.</i>	Proceedings of the Cambridge Philosophical Society.
<i>Proc. Phil. Soc. Glasgow</i>	Proceedings of the Glasgow Philosophical Society.
<i>Proc. Physiol. Soc.</i>	Proceedings of the Physiological Society.
<i>Proc. K. Akad. Wetensch. Amsterdam.</i>	Koninklijke Akademie van Wetenschappen te Amsterdam. Proceedings (English version).
<i>Proc. Roy. Soc.</i>	Proceedings of the Royal Society.
<i>Proc. Roy. Soc. Edin.</i>	Proceedings of the Royal Society of Edinburgh.



# JOURNALS FROM WHICH ABSTRACTS ARE MADE.

ABBREVIATED TITLE.	JOURNAL.
<i>Quart. J. Geol. Soc.</i> . . .	Quarterly Journal of the Geological Society.
<i>Rev. intern. Falsif.</i> . . .	Revue internationale des Falsifications.
<i>Rec. trav. chim.</i> . . .	Recueil des travaux chimiques des Pays-Bas et de la Belgique.
<i>Sci. Proc. Roy. Dubl. Soc.</i> .	Scientific Proceedings of the Royal Dublin Society.
<i>Sci. Trans. Roy. Dubl. Soc.</i>	Scientific Transactions of the Royal Dublin Society.
<i>Sitzungsber. K. Akad. Wiss. Berlin.</i>	Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin.
<i>Sitzungsber. K. Akad. München.</i>	Sitzungsberichte der königlich bayerischen Akademie der Wissenschaften in München.
<i>Trans. Amer. Inst. Mining Eng.</i>	Transactions of the American Institute of Mining Engineers.
<i>Trans. Nova Scotia Inst. Sci.</i>	Transactions of the Nova Scotia Institute of Science.
<i>Trans. Path. Soc.</i> . . .	Transactions of the Pathological Society.
<i>Trans. Roy. Soc. Canada.</i> .	Transactions of the Royal Society of Canada.
<i>Trans. Roy. Irish Acad.</i> . .	Transactions of the Royal Irish Academy.
<i>Tsch. Min. Mitth.</i> . . .	Tschermak's Mineralogische Mittheilungen.
<i>U.S.A. Dept. Agric. Bull.</i> .	Bulletins of the Department of Agriculture, U.S.A.
<i>U.S.A. Dept. Agric. Rep.</i> . .	Reports of the Department of Agriculture, U.S.A.
<i>Wiss. Abhandl. Phys.-Tech. Reichsanstalt.</i>	Wissenschaftliche Abhandlungen der Physikalisch Technischen Reichsanstalt.
<i>Zeit. anal. Chem.</i> . . .	Zeitschrift für analytische Chemie.
<i>Zeit. angew. Chem.</i> . . .	Zeitschrift für angewandte Chemie.
<i>Zeit. anorg. Chem.</i> . . .	Zeitschrift für anorganische Chemie.
<i>Zeit. Biol.</i> . . .	Zeitschrift für Biologie.
<i>Zeit. Elektrochem.</i> . . .	Zeitschrift für Elektrochemie.
<i>Zeit. Farb. Text. Chem.</i> . .	Zeitschrift für Farben- und Textil-Chemie.
<i>Zeit. Kryst. Min.</i> . . .	Zeitschrift für Krystallographie und Mineralogie.
<i>Zeit. Nahr. Genussm.</i> . . .	Zeitschrift für Untersuchung der Nahrungs- und Genussmittel.
<i>Zeit. öffentl. Chem.</i> . . .	Zeitschrift für öffentliche Chemie.
<i>Zeit. physikal. Chem.</i> . . .	Zeitschrift für physikalische Chemie, Stöchiometrie und Verwandtschaftslehre.
<i>Zeit. physiol. Chem.</i> . . .	Hoppe-Seyler's Zeitschrift für physiologische Chemie
<i>Zeit. prakt. Geol.</i> . . .	Zeitschrift für praktische Geologie.
<i>Zeit. Ver. deut. Zuckerind.</i> .	Zeitschrift des Vereins der deutschen Zucker-Industrie
<i>Zeit. Zuckerind. Böhm.</i> . .	Zeitschrift für Zuckerindustrie in Böhmen.



# JOURNAL

OF

## THE CHEMICAL SOCIETY.

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ABSTRACTS OF CHEMICAL PAPERS PUBLISHED IN  
BRITISH AND FOREIGN JOURNALS.

### PART II.

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#### General and Physical Chemistry.

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**Secondary Reactions in Grove's Gas Battery.** By EUGEN VON BIRON (*J. Russ. Phys. Chem. Soc.*, 1901, **33**, 474—480).—The author has measured the potential, relatively to that of a normal calomel electrode, of a platinised platinum electrode saturated with air in hydrochloric acid of different concentrations, the method of measurement being compensation by means of a capillary electrometer. The following table contains the mean values obtained, the concentrations being given in multiples of the normal strength :

Concentration.....	4	2	1	0.4	0.2	0.1	0.04	0.01
Potential.....	0.733	0.723	0.718	0.707	0.690	0.685	0.670	0.634

These results are compared with those given by Smale (Abstr., 1894, ii, 436) for an oxygen electrode in sulphuric and hydrochloric acids of the same concentrations as the above. In the case of sulphuric acid, the oxygen electrode gives slightly greater potentials than those of the author, but the numbers decrease with the concentration in a similar way. The values obtained by Smale for an oxygen electrode in hydrochloric acid show, however, a decided increase (from 0.415 to 0.665) as the concentration of the acid diminishes from 5 to 0.1 normal whilst with further dilution the potential decreases to 0.583 for 0.00025 *N* acid; this behaviour he explained as due to the action of chlorine ions formed by oxidation of the strong hydrochloric acid by

the oxygen. This explanation the author considers erroneous, as his own values show no such behaviour.

T. H. P.

**Cathodic Polarisation and Formation of Alloys.** By ALFRED COEHN (*Zeit. physikal. Chem.*, 1901, 38, 600—629).—The discharge potential of metallic ions at the cathode diminishes as a current is passed through an electrolyte solution and this is due to the formation of an alloy of the discharged metal and the metal of the cathode. This was ascertained by measuring the polarisation of the cathode against a normal (gas) electrode. The phenomenon is most clearly exhibited by a mercury cathode, but solid metals also form alloys. The cathodes used were mercury, platinum, copper, silver, and gold, and solutions of zinc, cadmium, iron, copper, silver, and mercury salts were examined.

The investigation of solutions containing ionic hydrogen leads to the conclusion that only with palladium is an alloy formed, since only with that metal as electrode could the discharge potential be lowered below the point of reversible separation of bubbles of gas. The curve representing the depression of the discharge potential, with *E.M.F.* applied with solutions of potassium hydroxide, shows two breaks. The first corresponds with the formation of a potassium alloy with the electrode; the second with the formation of a potassium hydrogen ion which cannot alloy with the electrode (mercury), but is decomposed by it. By applying the law of mass action, it is deduced that this substance has the formula  $KH_2$ .

When ammonium salts are used, the same phenomenon is observed as when alkali salts are examined, and this is evidence that ammonium amalgam exists and that ammonium is of a metallic nature.

J. McC.

**Dielectric Constants of Pure Solvents.** By HERMAN SCHLUNDT (*J. Physical Chem.*, 1901, 5, 503—526).—In continuation of previous work (Abstr., 1901, ii, 299), the dielectric constants of a large number of organic and inorganic compounds have been determined, among them many amines and nitro-compounds. The following are the values of the dielectric constant for some of the more important compounds:—Ethylene cyanide, 61.2 at 60°; ethylamine, 6.17 at 21°; nitromethane, 40.4 at 19°; nitroethane, 29.5 at 18°; methyl nitrate, 23.5 at 18°; ethyl nitrate, 18.3 at 18°; phosphorus trichloride, 3.36 at 22°; arsenic trichloride, 12.35 at 21°; antimony trichloride, 33.2 at 75° (liquid); 5.4 at 18° (solid); stannic chloride, 3.2 at 22°; phosphorus oxychloride, 13.9 at 22°; sulphuryl chloride, 9.15 at 22°; liquid sulphur dioxide, 12.35 at 22° (compare Coolidge, Abstr., 1900, ii, 4); bromine, 3.18 at 23°; liquid cyanogen, 2.52 at 23°. In homologous series, the dielectric constant diminishes as the molecular weight increases. The introduction of the cyanogen group in a compound causes a large increase in the value of the dielectric constant. There is no anomalous absorption in compounds containing a cyanogen, an amino-, or a nitro-group. Whilst a number of cases have been discovered where the Nernst-Thomson rule is applicable, striking exceptions to that rule have also been found, showing that the nature of the solvent is of prime importance in determining whether a solution

will conduct electricity. Obach's law is found to hold only approximately for the nitriles.  
J. C. P.

**Electrical Conductivity of Sodium and Potassium Hydroxides in Glycerol.** By GIUSEPPE DI CIOMMO (*Il Nuovo Cimento*, 1901, [v], 2, 81—87).—The author has measured the electrical conductivities of solutions of various concentrations and at various temperatures, of sodium and potassium hydroxides in 96 per cent. glycerol, the method of measurement being that of Kohlrausch. The results, which are given in the form both of tables and curves, show that the conductivities are much less than those of aqueous solutions of the hydroxides, the maximum values in glycerol being less than one-millionth of those in water. At the temperatures employed, 14° to 30°, the maximum conductivity of sodium hydroxide in glycerol occurs with a concentration of 5 per cent., the corresponding concentration for potassium hydroxide being 7.03 per cent. These concentrations are directly proportional to the molecular weights of the two hydroxides, a relation which does not hold in the case of aqueous solutions. The temperature coefficients of the conductivities are very high, reaching the values 0.21 and 0.17 for sodium and potassium hydroxides, whilst for aqueous solutions the maximum values of these coefficients are 0.03 and 0.07 respectively. In both glycerol and water, the maxima of conductivity correspond with weaker solutions of sodium than of potassium hydroxide.  
T. H. P.

**Dispersion of the Lines of Current in Electrolytes.** By W. PFANHAUSER, jun. (*Zeit. Elektrochem.*, 1901, 7, 895—897).—In electroplating objects of irregular shape, the author considers that the current lines tend to concentrate at the points of the cathode nearest to the anode, just as the lines of force in the magnetic field of a horse-shoe magnet are most concentrated at the points of the poles which are nearest together. The lines of current are more evenly spread over the whole surface of the object with some electrolytes than with others, and the author proposes the theory that the spreading is proportional to the difference between the discharge potentials of the cations of the "conducting salt" (usually K·, Na·, or H·) and of the metal which is to be deposited.  
T. E.

**Dissociation Relationships of Ternary Electrolytes.** By KARL DRUCKER (*Zeit. physikal. Chem.*, 1901, 38, 602—608).—Assuming that a ternary electrolyte,  $AB_2$ , can only dissociate into  $A^+$ ,  $AB^+$ , and  $B'$  (or  $A''$ ,  $AB'$ , and  $B^+$ ), then  $(G' - G) = (c - e)$ , where  $G'$  is the osmotic concentration (obtained from a cryoscopic determination),  $G$  the concentration determined analytically,  $c$  the concentration of the ions  $B'$ , and  $e$  the concentration of the undissociated substance. If  $e$  is very small, then  $(G' - G) = c$ . The results of Loomis (*Abstr.*, 1896, ii, 352; 1897, ii, 305) and Wildermann (*Abstr.*, 1896, ii, 351) on the freezing point of solutions of sulphuric acid give values for  $(G' - G) = c$  (the concentration of hydrogen ions), which agree with the values calculated for  $c$  from the conductivity of sulphuric acid solutions (up to 0.1N), assuming that  $c_{H_2SO_4} = 0$ . The author concludes that in 0.1N sulphuric

acid solution, although the degree of dissociation is only 0.55, no  $\text{HSO}_4'$  is present. J. McC.

**Influence of Electrical Waves on Chemical Action.** By FELIX LENGFELD and JAMES H. RANSOM (*J. Physical Chem.*, 1901, 5, 502).—Electrical waves of 300 metres are without effect on mixtures of hydrogen and chlorine or hydrogen and oxygen. J. C. P.

**Phenomenon observed in the Inversion of Flame.** By E. MAMELI and M. COMELLA (*Gazzetta*, 1901, 31, ii, 255).—A modification of the lecture experiment, showing, by the burning of air in coal gas, that the terms combustible and supporter of combustion are merely relative, is described, by which it is possible to produce an isolated flame which does not appear at the orifice of either the gas or air tube; the flame obtained consists of two parts, in one of which the gas burns in air, whilst in the other the air burns in the coal gas. T. H. P.

**Determination of the Calorific Power of Fuels.** By UBALDO ANTONY and E. DI NOLA (*Gazzetta*, 1901, 31, ii, 277—284).—A reply to the criticisms of Rebuffat (*Abstr.*, 1901, ii, 373) on the authors' previous paper (*Abstr.*, 1901, ii, 6) on Berthier's method of determining the calorific value of fuels. T. H. P.

**Heat developed by the Action of Oxygen on Alkaline Pyrogallol.** By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1901, 133, 664—666).—The action of oxygen on a solution of pyrogallol in potassium hydroxide develops, at first, 60 Cal. for each atom of oxygen absorbed, but the quantity of heat liberated for a given quantity of oxygen absorbed becomes less as the action proceeds. The development of heat is progressive, even at first, and seems to be due to several consecutive reactions. C. H. B.

**Inversion Points of Heats of Dilution.** By ALBERT COLSON (*Compt. rend.*, 1901, 133, 585—587).—If curves are constructed representing the heat of dissolution against temperature for solutions of sodium chloride at different concentrations, it is found that they cut at the temperature  $52^\circ$ . This is, hence, an inversion point for the heat of dilution, which becomes zero. Addition of hydrogen chloride or sodium hydroxide causes a rise of this temperature of inversion, the values  $80^\circ$  and  $83^\circ$  being obtained in  $N$  solutions of these compounds, and  $100^\circ$  and  $100.8^\circ$  in  $2N$  solutions. L. M. J.

**Thermodynamics of Concentrated Solutions.** By A. SCHÜKAREFF (*Zeit. physikal. Chem.*, 1901, 38, 543—560).—In a system consisting of two components, it is deduced that  $\mu - \mu_0 = k'(1/c_0 - 1/c)$  and  $\mu' - \mu'_0 = k'(1/c'_0 - 1/c')$ , where  $\mu$  is the potential when the concentration is  $c$ . This is the same as Gibbs' formula, provided that  $c$  and  $c_0$  do not lie far apart. It is the expression for the work done on introducing each unit of substance into the system, provided that no chemical action takes place. The author applies this to (a) the distribution of a substance between two immiscible solvents, or between a



liquid and a solid solvent, (b) speed of solution, (c) diffusion (in solution), and (d) depression of solubility by addition of a salt containing the same cation.

J. McC.

**New Proof of the Formula  $d = 0.02T^2/L$ .** By FELIX LENGFELD (*J. Physical Chem.*, 1901, 5, 499—501).—The proof is based on the supposition that the solvent may be supercooled indefinitely, and that the specific heats of the solid and liquid are constants from absolute zero to the normal melting point.

J. C. P.

**Pipette for Determining the Density of Liquids.** By FERNAND GIRARDET (*Bull. Soc. Chim.*, 1901, [iii], 25, 936—943).—The apparatus, of which a figure is given in the paper, consists of two vertical glass tubes the lower ends of which dip respectively into water and the liquid under examination, whilst the upper extremities are connected with a rubber tube by which suction may be applied. Behind each tube is a paper scale. The heights to which the two liquids rise are inversely proportional to their densities. The paper gives details of the construction and use of the instrument, and also a mathematical demonstration of its principle, sensibility, and relative error.

N. L.

**Laws of Internal Friction.** By LADISLAUS NATANSON (*Zeit. physikal. Chem.*, 1901, 38, 690—704).—A mathematical paper in which the laws of internal friction of liquids are deduced from the consideration of the inequalities of pressure produced in a liquid during a deformation.

L. M. J.

**Viscosity of Helium and its Alteration with Temperature.** By H. SCHULTZE (*Ann. Phys.*, 1901, [iv], 6, 302—314).—By a method previously used in the case of argon (*Ann. Phys.*, 1901, [iv], 5, 140), the author finds the viscosity of helium at 15° to be 1.086 times as great as that of air, whereas Rayleigh found the ratio to be 0.96. For  $n$  and  $c$  (compare Rayleigh, *Abstr.*, 1900, ii, 590; 1901, ii, 9), the author's values agree well with those obtained by Rayleigh.

J. C. P.

**Plastic and Adhesive Properties of Glass at the Ordinary Temperature.** By JULES PICCARD (*Ber.*, 1901, 34, 3635—3639).—A regular even scratch was made with a diamond on a glass plate which was then broken into some twelve rectangular strips. One-half of the strips were clamped at one end in a horizontal position with the scratch on the upper surface, and weights were placed on the free ends until the plate snapped along the scratch. The remainder of the plates were clamped as before but with the scratch on the under surface and the free ends weighted with small weights varying from 50—375 grams, and were left in this position for several days at the ordinary temperature. When the plates were reversed and weights placed on the free ends until the plates broke, it was found that in all these cases the weights required were some 20 per cent. greater than

in the first series of plates. This would indicate that the scratch, which was originally 0.1 mm. in depth, had been partially healed owing to the plastic and adhesive properties of the glass under slight pressure.

J. J. S.

**Determination of the Molecular Weights of Volatile Substances by the Boiling Point Method.** Behaviour of Iodine and some Inorganic Oxyhaloids. By GIUSEPPE ODDO (*Gazzetta*, 1901, 31, ii, 222—243. Compare Oddo and Serra, *Abstr.*, 1900, ii, 73 and 74).—The molecular weight of a volatile compound, as determined by the boiling point method, is given by the formula:  $M = (c_2 - c_1)K/\Delta$ , where  $c_2$  and  $c_1$  are the concentrations of the dissolved substance in the solution and in the vapour respectively,  $K$  the molecular increase of boiling point of the solvent and  $\Delta$  the observed rise in boiling point; or, representing  $c_1/c_2$ , which is almost constant for different concentrations, by  $a$ ,  $M = c_2(1 - a)K/\Delta$ . The author has devised an apparatus which is a modification of Beckmann's and allows the necessary data for the above calculation to be obtained from one experiment. It consists of a glass adapter for holding the thermometer, ground to fit the boiling tube; the thermometer may be either ground in or fixed by means of a thin ring of cork. The side tube of the flask is connected in a similar manner with a condenser which can be used either for reflux or, by rotation in the side tube, for distillation. The apparatus is used as follows: The boiling tube having been charged with the solvent and surrounded by a vapour jacket, the boiling point of the solvent is measured in the ordinary way; the substance is then added and the boiling point of the solution measured. The heating is then suspended for a few moments while the condenser is turned into the position for distillation and connected with a tared flask which is surrounded with ice. After a certain quantity of liquid has been distilled over, the temperature is again read and the flasked re-weighed. The amount of dissolved substance in the distillate is then determined. The compounds examined by this method were: (1) iodine in chloroform, tetrachloromethane, ethyl alcohol, and benzene; (2) phosphorus oxychloride in tetrachloromethane, benzene, and chloroform; (3) thionyl chloride in chloroform; (4) phosphorus oxybromide in benzene; (5) phosphorus sulphochloride in benzene; (6) sulphur monochloride in tetrachloromethane and benzene. From these results, which are given in detail, and those previously obtained (*loc. cit.*), the author draws the following conclusions: in boiling carbon disulphide, benzene, or alcohol, the molecule of iodine is diatomic, whilst in chloroform and tetrachloromethane tetratomic molecules are also found. The colour of iodine solutions is not influenced by the number of atoms in the molecule, since carbon disulphide, chloroform, and tetrachloromethane all yield violet solutions. Some of the inorganic oxyhaloid compounds also tend to polymerise in certain solvents; this is principally the case with phosphorus oxychloride in tetrachloromethane in which the mol. weight is 194—250, and in benzene in which the values vary from 228 to 234, the simple molecule having a weight of 153.5; polymerisation also occurs, although to a less degree, with thionyl chloride in



chloroform, phosphorus oxybromide and sulphochloride in benzene, and to a very slight extent with sulphur monochloride in tetrachloromethane and benzene. In freezing benzene, all these oxyhaloids exist in a non-polymerised condition, as also do chromyl and sulphuryl chlorides. Phosphorus oxydichloromonoanilide,  $\text{NHPb} \cdot \text{POCl}_2$ , shows a marked tendency to polymerise in both freezing and boiling benzene. The phenoxy-derivatives of phosphorus oxychloride,  $\text{PhO} \cdot \text{POCl}_2$  and  $\text{PO}(\text{OPh})_3$ , exist as simple molecules in boiling benzene. Phosphorus pentachloride is not polymerised in boiling tetrachloromethane, but sulphur has the formula  $\text{S}_8$ ; the mono- and tri-chlorides of iodine lower the boiling point of this solvent, owing to dissociation.

T. H. P.

**Solubility of Salts. IX. Barium Oxalate.** By E. GROSCHUFF (*Ber.*, 1901, 34, 3313—3325).—The *hydrate*,  $\text{BaC}_2\text{O}_4 \cdot 3\frac{1}{2}\text{H}_2\text{O}$ , is obtained by mixing at  $0^\circ$  concentrated solutions of ammonium oxalate and barium chloride, and is also frequently formed in place of the dihydrate on mixing at  $0^\circ$  dilute solutions of barium hydroxide and oxalic acid; it forms minute, white, pointed needles, is stable at  $18^\circ$ , but effloresces to the hemihydrate in warm weather, and is also converted to the same hydrate by shaking with water. It dissolves in 215 mols. of water at  $0^\circ$ , 152 mols. at  $9.5^\circ$ , 111 mols. at  $18^\circ$ , and 73.4 mols. at  $30^\circ$ .

The *hydrate*,  $\text{BaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ , is best prepared by the slow decomposition of the acid oxalates by water at the atmospheric temperature; it is also formed when oxalic acid is neutralised with barium hydroxide or barium carbonate. It forms hexagonal, monoclinic tablets, and is the easiest of all the hydrates to recognise under the microscope. Above  $50^\circ$ , it decomposes to the hemihydrate. It dissolves in 236 mols. of water at  $0^\circ$ , 103 mols. at  $30^\circ$ , 50 mols. at  $65^\circ$ , and 43.8 mols. at  $73^\circ$ .

The hydrate,  $\text{BaC}_2\text{O}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ , is formed above  $50^\circ$ , and best at  $100^\circ$ , on extracting the acid oxalate with water, on heating the anhydrous salt or any of the other hydrates with water, or on heating any of the dry hydrates; it also appears frequently at  $0^\circ$  in place of the hydrate with  $3\frac{1}{2}\text{H}_2\text{O}$ . It forms obliquely truncated, four-sided prisms, and is soluble in 144 mols. of water at  $0^\circ$ , in 76.2 mols. at  $50^\circ$ , and in 59.2 mols. at  $100^\circ$ .

The anhydrous salt crystallises in forms similar to those of the hemihydrate; it is formed by heating the hemihydrate at  $140$ — $150^\circ$ , and is readily reconverted into it by boiling water.

The hydrate,  $\text{BaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ , described by several authors, does not appear to exist.

The solubility curves for  $\text{BaC}_2\text{O}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ , and  $\text{BaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ , intersect at  $40^\circ$ ; above this temperature, the hemihydrate is the less soluble, and would be the form stable in contact with water, whilst below  $40^\circ$  the dihydrate is the stable and less soluble form. The curve for the hydrate with  $3\frac{1}{2}\text{H}_2\text{O}$  does not intersect that for the dihydrate above  $0^\circ$ , but the curves, if produced, would intersect at a point corresponding with a temperature slightly below  $0^\circ$ ; the hydrate with  $3\frac{1}{2}\text{H}_2\text{O}$  must therefore always be a labile form when in contact with water.

The values given for the solubility are much lower than those previously observed; this is probably due to supersaturation.

The *acid oxalate*,  $\text{BaC}_2\text{O}_4 \cdot \text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ , undergoes a reversible decomposition in presence of water, and in contact with the solid salt its solutions contain oxalic acid and barium oxalate and are saturated both with regard to the neutral and the acid oxalate. At  $0^\circ$ , 100 mols. of water dissolve from the acid oxalate 0.054 mol.  $\text{H}_2\text{C}_2\text{O}_4$  and 0.0024 mols.  $\text{BaC}_2\text{O}_4$ , or 22 mols.  $\text{H}_2\text{C}_2\text{O}_4$  to 1 mol.  $\text{BaC}_2\text{O}_4$ ; at  $99^\circ$ , 100 mols. dissolve 2.39 mols.  $\text{H}_2\text{C}_2\text{O}_4$  and 0.141 mol.  $\text{BaC}_2\text{O}_4$ , the ratio being 17 to 1. The temperature at which oxalic acid and barium oxalate would dissolve in mol. proportions, that is, at which the acid salt would dissolve without decomposition, lies far below the temperature of experiment; the temperature at which the acid salt would be completely decomposed and the solution become saturated with regard to both barium oxalate and to oxalic acid also lies beyond the temperature of experiment; the salt is therefore within its "transition limits" (Meyerhoffer, *Zeit. physikal. Chem.*, 1890, 5, 120) throughout the whole range of observation. T. M. L.

**State of Dissolved Compounds deduced from Partition Coefficients.** By ARTHUR HANTZSCH and AUGUST VAGT (*Zeit. physikal. Chem.*, 1901, 38, 705—742).—If a compound is divided between two mutually insoluble liquids, then the ratio of the concentrations should be independent of the quantity dissolved; that is, the partition coefficient should be constant. If dissociation occurs in one solvent, then the equilibrium must only be considered for the undissociated molecules, that is  $C_1(1-x)/C_2 = \text{constant}$ . It has been shown, however, by Hantzsch and Sebaldt (*Abstr.*, 1900, ii, 69) that the partition coefficient in the case of amines varies greatly with temperature changes. This work has been considerably extended, and the influence of temperature on a large number of partition coefficients has been determined. The partition coefficients were found to be independent of temperature in the following systems—mercuric chloride in water and toluene, hydrogen cyanide in water and benzene, ethylene cyanide in water and chloroform, acetone in water and toluene, formaldehyde in water and ether, chloral hydrate in water and ether or toluene. For these, therefore, the partition laws hold, and the solvents may be regarded as indifferent, that is, having no effect on the molecular state of the solute. This was not the case, however, in the following cases—trimethylamine, triethylamine, pyridine, or collidine in water and toluene; here the coefficient decreased with rise of temperature, whilst as a similar decrease was obtained when the toluene is replaced by ether, the cause must be sought in the aqueous solution, and the authors consider it is due to the formation of hydrates which decompose with rise of temperature. Similar results were obtained for the systems bromine in water and air, and iodine in glycerol (or aqueous glycerol) and chloroform, so that halogen hydrates or glycerates are indicated. A constant coefficient is obtained, however, for iodine in glycerol and ether, so that iodine etherates also exist. It is noteworthy that when two iodine solutions are of similar colour they yield a constant partition coefficient. Temperature changes caused varia-

tions in the opposite sense with solutions of ferric or chromium thiocyanates in water and ether, the relative concentration of the aqueous solution increasing with temperature. The authors hence consider that ethereal compounds decomposed at higher temperatures must be formed. For compounds of the type of amines also the coefficient increases on dilution. The effect of added compounds was also partially investigated, but the completion and consideration of this work is postponed.

L. M. J.

**Simultaneous Equilibrium and the Relations between Thermodynamics and Velocity of Reaction of Homogeneous Systems.** By RUDOLF WEGSCHEIDER (*Monatsh.*, 1901, 22, 849—906. Compare Euler, *Abstr.*, 1901, ii, 57).—By purely mathematical treatment, the relations between the conditions of equilibrium found by a thermodynamical method and those obtained from a kinetic standpoint are considered. The author comes to the conclusion that different conditions of equilibrium result from each method of treatment, and discusses the meaning of this paradox.

K. J. P. O.

**Limit of Chemical Reactions and of the Product  $PV$ .** By A. PONSOT (*Compt. rend.*, 1901, 133, 618).—The author states the following conclusions.

a. The two hypotheses: (1) that  $PV$  tends to a limiting value for  $V = \infty$ , (2) that chemical reactions may be complete, are incompatible.

b. The two hypotheses: (1) that  $PV$  tends to a limiting value for  $V = \infty$ , (2) that chemical reactions are always limited, are compatible.

c. The two hypotheses: (1) that  $P = 0$  for very great values of  $V$ , (2) that there are complete and limited chemical reactions, are compatible.

L. M. J.

**Velocity of Reaction of Bromine on Ethyl Alcohol.** By STEFAN BUGARSKY (*Zeit. physikal. Chem.*, 1901, 38, 561—601).—Bromine reacts on an aqueous solution of ethyl alcohol in the cold at a measurable rate; the speed is not constant throughout the reaction, for, as the concentration of hydrogen bromide increases, more bromine is withdrawn from the sphere of reaction by formation of hydrogen tribromide ( $\text{HBr}_3$ ) and so the reaction slackens. Provided that the alcohol is in excess and that the action takes place in the cold, no bromine substitution products are formed, and the only other product of the reaction besides hydrogen bromide is ethyl acetate.

No constant could be obtained for the expression of a reaction of the first, second, or third order from the results obtained at  $25^\circ$  for the extent of reaction after the lapse of known times with solutions of bromine (up to 0.008 gram-molecule per litre) in alcohol to which  $1/5$  of its volume of water had been added. The application of the formulæ of Ostwald and of Noyes for the determination of the order of a reaction in which secondary changes take place leads to the conclusion that the action of ethyl alcohol on bromine is unimolecular. Van't Hoff's formula also shows that the reaction is unimolecular, and, since the value obtained with the aid of the latter formula is more nearly  $= 1$  than that obtained with the former, it is clear that the disturbance is

caused by a product of the reaction. It has been proved experimentally that the hydrogen bromide, and not the ethyl acetate, is the disturbing factor. The first reaction,  $2\text{C}_2\text{H}_5\text{O} + 2\text{Br}_2 \rightarrow \text{C}_4\text{H}_8\text{O}_2 + 4\text{HBr}$ , is unimolecular, and the second reaction,  $\text{HBr} + \text{Br}_2 \rightleftharpoons \text{HBr}_3$ , takes place at an incomparably greater rate. It is deduced that the velocity of the primary reaction is given by  $k = 1/(t - t_0) \cdot \log(T_0/T)$ , where  $T_0$  is the concentration of bromine at time  $t_0$ , and  $T$  that at time  $t$ . The value of  $K$ , the equilibrium constant of the secondary reaction, is found from the expression  $K = 1/(t - t_0) \cdot \Sigma/k \cdot \log(T_0/T)$ , wherein  $\Sigma$  is the sum of the concentrations of bromine and hydrogen bromide. The mean value obtained for  $k$  from five series of measurements is 0.1052. The value obtained for  $K$  is 0.00441. Addition of lithium or ammonium bromide in 0.1*N* solution does not alter the value of  $k$  and this is in consonance with the electrolytic dissociation of  $\text{HBr}_3$  into  $\text{H}^+$  and  $\text{Br}_3^-$ . The values of  $k$  obtained from solutions containing bromine in greater concentration than 0.01*N* are not constant, but if mercuric bromide be added to the solution, then the bromine ions which are formed are taken up with production of  $\text{HgBr}_4$  (Abstr., 1893, ii, 566) and the reaction proceeds unimolecularly.

J. McC.

## Inorganic Chemistry.

**Reactions of Hydrogen Peroxide.** By ARNOLD NABL (*Monatsh.*, 1901, 22, 737—744. Compare Abstr., 1901, ii, 16, 94).—Hydrogen peroxide and sodium thiosulphate react according to the equation:  $2\text{Na}_2\text{S}_2\text{O}_3 + \text{H}_2\text{O}_2 = 2\text{NaOH} + 2\text{Na}_2\text{S}_4\text{O}_6$ . If the alkali is not neutralised, 75 per cent. of the thiosulphate remains unoxidised and the reaction leads to the formation of sulphate and dithionate as well as tetrathionate:  $2\text{Na}_2\text{S}_2\text{O}_3 + 7\text{H}_2\text{O}_2 = 2\text{Na}_2\text{SO}_4 + \text{H}_2\text{S}_2\text{O}_6 + 6\text{H}_2\text{O}$ ;  $\text{H}_2\text{S}_2\text{O}_6 + \text{H}_2\text{O}_2 = 2\text{H}_2\text{SO}_4$ .

Barium sulphite and hydrogen peroxide give a small quantity of dithionate as well as of sulphate when the sulphite is in excess. The reactions represented by the equations  $2\text{H}_2\text{SO}_3 + \text{H}_2\text{O}_2 = 2\text{H}_2\text{O} + \text{H}_2\text{S}_2\text{O}_6$  and  $\text{H}_2\text{S}_2\text{O}_6 + \text{H}_2\text{O}_2 = 2\text{H}_2\text{SO}_4$ , therefore take place simultaneously.

K. J. P. O.

**Alkali Salts of Hydrogen Peroxide in Aqueous Solution.** By HARRY T. CALVERT (*Zeit. physikal. Chem.*, 1901, 38, 513—542).—An historical account of the peroxides of the alkali metals is given. For the experiments, the hydrogen peroxide was prepared by repeated distillation until the conductivity was constant, and then concentrated on the water-bath. The distribution ratio of hydrogen peroxide between water and ether at 20° is 15.6 and is independent of the concentration. A constant ratio (7.03 at 25°, and 6.65 at 0°) was also found when the ether was replaced by amyl alcohol, and this is not altered by the addition of acids. In presence of alkalis, the distribu-



tion ratio is increased and the curve representing the change of ratio with increasing concentration of hydrogen peroxide approaches asymptotically to a line denoting the ratio on the assumption that 1 mol. of alkali fixes  $1\frac{1}{2}$  mols. of hydrogen peroxide. Addition of hydrogen peroxide diminishes the saponifying power of sodium hydroxide, indicating that hydroxyl ions disappear.

The conductivity of hydrogen peroxide solutions was determined in a modified Kohlrausch cell, in which the electrodes consisted of tinned iron, which does not catalyse the solution. The conductivity of alkali salt solutions is very slightly diminished by addition of hydrogen peroxide; that of solutions of hydroxides of the alkali metals is very greatly reduced. This is explained on the assumption that with the hydroxyl ions the hydrogen peroxide forms superoxide ions, the migration-velocity of which is small compared with that of the hydroxyl ions. Using the Ostwald-Walden rule, the author calculates the migration-velocity of this new anion to be 48.5 (Kohlrausch and Holborn units), the same value being found from solutions containing the cations  $\text{Li}^+$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Rb}^+$ , and  $\text{Cs}^+$ .

The migration of the superoxide anion has been proved experimentally by the method described by Noyes and Blanchard (Abstr., 1901, ii, 91), lead oxide being used as indicator.

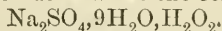
From the depression of the freezing point of water containing sodium hydroxide and hydrogen peroxide, using excess of the latter to diminish the hydrolysis, it is shown that the anion is univalent and is derived from the hydroxyl ion and neutral hydrogen peroxide (Abegg and Bodländer, Abstr., 1899, ii, 542). The results are in agreement with the assumption that the ion is  $\text{O}_2^-$  and the compound formed from sodium hydroxide and hydrogen peroxide is  $\text{NaO}_2$ .

The solubility of potassium chlorate in hydrogen peroxide is much greater than that in pure water, and consequently such a determination could not be used to ascertain if the hydrogen peroxide forms a complex ion with the cation.

J. McC.

**Molecular Compounds of Hydrogen Peroxide with Salts.** By SIMEON L. TANATAR (*Zeit. anorg. Chem.*, 1901, 28, 255—257).—The compound  $\text{KF} \cdot \text{H}_2\text{O}_2$  is obtained by dissolving potassium fluoride in 15 per cent. hydrogen peroxide and evaporating at  $50^\circ$  so long as no serious decomposition occurs. It crystallises in monoclinic needles, is not hygroscopic, but exceedingly soluble in water, is not decomposed at  $70^\circ$  and only partially so at  $110^\circ$ , and is fairly stable when dry.

A similar compound is obtained by dissolving sodium sulphate in 3 per cent. hydrogen peroxide and has the composition



With sodium nitrate, the double salt,  $\text{NaNO}_3 \cdot \text{Na}_2\text{O}_2 \cdot 8\text{H}_2\text{O}$ , is obtained. It is very unstable.

E. C. R.

**Generalisations on Halogen Double Salts.** By HORACE L. WELLS (*Amer. Chem. J.*, 1901, 26, 389—408).—A long list is given of halogen double salts of the alkali metals, ammonium, and univalent thallium, with negative metals; the salts are arranged according to types, which are designated by ratios indicating the number of atoms of each metal present.

The remarkable similarity in the prominent types of the series of different valencies leads to the conclusion that the valency of the metal of a negative haloid has no influence on the types of double salts which it forms. The molecules of alkali haloids have nearly the same combining power as molecules of negative haloids. Salts of simple types (particularly the 2:1 and 1:1 ratios) predominate. Remsen's law which states that the number of alkali haloid molecules which can combine with a negative haloid molecule is not greater than the valency of the metal of the latter, must be abandoned. The double haloids appear to increase in variety and ease of formation from the iodides to the fluorides. They may be classified in three groups, based upon their behaviour in solution. (1) Salts, such as potassium platinichloride, which undergo ionisation into alkali metal ions and complex negative ions. (2) Salts which readily separate into their component haloids in solution, but can be recrystallised unchanged from water or from dilute acid solutions. (3) Salts which require the presence of an excess of one of their component haloids in solution for their formation. E. G.

**Tri-iodides.** By YUKICHI OSAKA (*Zeit. physikal. Chem.*, 1901, 38, 743—749).—The addition of iodine to a solution of potassium iodide or hydrogen iodide produces a rise of the freezing point proportional to the quantity of iodine added, and greater for the hydrogen than for the potassium salt. Hence it follows that the total concentration of ions and undissociated molecules is decreased by the addition of iodine. This necessitates a greater affinity constant for the iodides than for the tri-iodides, so that Dawson's assumption that these affinity constants are equal is incorrect (*Trans.*, 1901, 79, 238). L. M. J.

**Influence of the Concentration of the Hydrogen Ions on the Action of Iodates on Haloid Salts.** By HUGO DITZ and B. M. MARGOSCHES (*Zeit. angew. Chem.*, 1901, 14, 1082—1091).—Potassium iodate and iodide readily react in the presence of a small amount of an acid (hydrogen ions) liberating iodine, and the amount thus deposited is directly proportional to the amount of acid present (Fessel, *Zeit. anorg. Chem.*, 1900, 23, 66). Potassium bromide and iodate do not react so readily in the presence of an acid (Bugarszky, *Abstr.*, 1896, ii, 216) and the iodine ions are only transformed into free iodine when the concentration of the hydrogen ions exceeds a certain minimum. Potassium chloride reacts less readily than the bromide and the necessary concentration of hydrogen ions is much greater.

When definite amounts of hydrochloric or sulphuric acid are added to a potassium iodide solution mixed with an excess of iodate, the amounts of iodine liberated and of iodate left are found to correspond with the amounts required for the given quantities of acid employed. The free iodine was extracted with toluene and titrated with *N*/10 thiosulphate and the residual iodate was titrated by means of the same reagent. When acetic acid is added to a potassium iodide-iodate mixture, the reaction is not normal and the residual iodate is always less than that required by theory; similar results

have been obtained when acetic acid was used in presence of sodium acetate. The anomaly is probably due to the formation of an organic iodine derivative.

Boric acid is not capable of liberating iodine from an iodide-iodate mixture except in the presence of glycerol or dextrose. The same acid does not liberate free halogen from a bromide-iodate mixture, even in the presence of glycerol. Phenol also is incapable of liberating iodine, but picric acid liberates a small amount from an iodide-iodate mixture.

With mixtures of bromide, iodide, and iodate in the presence of acetic or hydrochloric acid, the amount of iodine liberated corresponds with the reaction between the iodide and iodate. A bromate-iodide mixture also yields iodine on treatment with acids, but requires the addition of several c.c. of *N*/10 acid before the liberation of iodide is started.

A bromide-bromate mixture in the presence of acetic acid and sodium acetate yields no free halogen.

A chlorate-iodide solution, even in the presence of considerable excess of dilute hydrochloric acid liberates but little iodine; concentrated acid, on the contrary, liberates a much larger amount.

J. J. S.

**Supposed Anomalous Behaviour of Oxygen at Low Pressure.** By MAX THIESEN (*Ann. Phys.*, 1901, [iv], 6, 280—301).—The author's observations are quite unfavourable to the supposed existence of an anomaly for oxygen under 0·7 mm. pressure (compare Bohr, *Ann. Phys. Chem.*, 1886, [ii], 27, 459; Rayleigh, *Abstr.*, 1901, ii, 542).

J. C. P.

**Dissociating Power of Hydrogen Sulphide.** By WM. T. SKILLING (*Amer. Chem. J.*, 1901, 26, 383—384).—When a solution of potassium chloride in liquid hydrogen sulphide is placed in a tube provided with platinum electrodes and connected with a battery of 40 volts, no conduction takes place.

E. G.

**Catalytic Reactions. II. Decomposition of Chlorosulphonic Acid into Sulphuryl Chloride and Sulphuric Acid.** By OTTO RUFF (*Ber.*, 1901, 34, 3509—3515).—At 170°, the reaction,  $2\text{SO}_3\text{HCl} \rightleftharpoons \text{SO}_2\text{Cl}_2 + \text{H}_2\text{SO}_4$ , is a reversible one, and after 72 hours, the equilibrium reached is  $1\text{SO}_2\text{Cl}_2 : 1\text{H}_2\text{SO}_4 : 2\cdot5\text{SO}_3\text{HCl}$ ; sulphur dioxide and chlorine are not formed between 170° and 190°, although at a higher temperature they begin to be noticeable. Obviously, therefore, the sulphuryl chloride is not formed by the union of sulphur dioxide and chlorine, initially produced by complete dissociation of the chlorosulphonic acid (compare Heumann and Köchlin, *Abstr.*, 1883, 781), but is a direct decomposition product; this is emphasised by the fact that, when the formation of the sulphuryl chloride occurs at the boiling point of the chlorosulphonic acid owing to the presence of a catalytic agent its amount is not increased by the passage of a current of chlorine and sulphur dioxide through the liquid. When sulphur dioxide and chlorine are produced at a high temperature, they



are due to the latter causing decomposition in the sense of the equation  $\text{SO}_3 + 2\text{HCl} = \text{SO}_2 + \text{H}_2\text{O} + \text{Cl}_2$ .

Mercuric salts rapidly decompose chlorosulphonic acid at its boiling point into sulphuryl chloride and sulphuric acid, and several other salts effect a similar result, only more slowly. The figures after the names of the following salts indicate the number of grams of sulphuryl chloride formed by boiling 50 grams of the acid for 60 minutes with 1 gram of the salt. Mercuric chloride and sulphate, each 13.0; mercury, 12; antimony penta- and tri-chloride, 7.5; stannic chloride, 5.8; bismuth chloride, 3.3; platinic chloride, 2.5; uranyl chloride, 1.7; gold chloride, 1.2; copper sulphate, 0.8; tungsten chloride, 0.8; lead chloride, 0.7; cobalt sulphate, 0.5, and magnesium chloride, 0.5; the chlorides of zinc, aluminium, iron, calcium, and sodium are without action. As the whole of the chlorosulphonic acid is easily decomposed by boiling with mercuric chloride, the method is probably capable of commercial application for the manufacture of sulphuryl chloride.

The mercuric chloride is not changed at all in the action, but mercuric sulphate is converted into mercuric chloride; sodium chloride dissolves in chlorosulphonic acid with evolution of hydrogen chloride and production of the *sodium* salt,  $\text{ONa} \cdot \text{SO}_2 \cdot \text{Cl}$ , which is precipitated by the addition of sulphuryl chloride and is readily decomposed by water.

W. A. D.

**Formation of Dithionic Acid.** By JULIUS MEYER (*Ber.*, 1901, 34, 3606—3610).—The formation of barium dithionate, by passing sulphur dioxide into water in which manganese dioxide is suspended, is probably to be represented by the following equations:  $2\text{MnO}_2 + 3\text{H}_2\text{SO}_3 = \text{Mn}_2(\text{SO}_3)_3 + 3\text{H}_2\text{O} + \text{O} = \text{MnS}_2\text{O}_6 + \text{MnSO}_3 + 3\text{H}_2\text{O} + \text{O}$ , as manganous sulphite and sulphate are always formed in appreciable quantity. Ferric hydroxide and sulphurous acid, in the absence of air and at low temperatures, yield ferrous sulphite and ferrous dithionate,  $\text{Fe}_2(\text{SO}_3)_3 = \text{FeSO}_3 + \text{FeS}_2\text{O}_6$ . Cobaltic and nickelic hydroxides react with sulphurous acid in a similar manner. Lead, barium, magnesium, and sodium peroxides do not yield dithionates on treatment with sulphurous acid (compare Carpenter, *Trans.*, 1902, 81, 1).

The electrical conductivities and freezing points of barium dithionate solutions are given, and the formula  $\text{H}_2\text{S}_2\text{O}_6$  for the acid is considered to be proved (compare Ostwald, *Zeit. physikal. Chem.*, 1887, 1, 106).

J. J. S.

**So-called Sulphimide.** By ARTHUR HANTZSCH and A. HOLL (*Ber.*, 1901, 34, 3430—3445. Compare W. Traube, *Abstr.*, 1892, 1389; 1893, ii, 268).—Sulphamide is unimolecular, and, in the pure state, not an electrolyte, and corresponds with carbamide; sulphimide, on the other hand, is termolecular and corresponds with cyanuric acid. Sulphamide is best purified by repeated crystallisation from ethyl alcohol; it forms rhombic plates melting at  $91.5^\circ$  (Traube,  $75-81^\circ$ ), is perfectly tasteless, and quite neutral. In the preparation of sulphamide by the action of sulphuryl chloride on a light petroleum solution of ammonia, several bye-products are formed, but the composition of these has not been determined.

Trisulphimide,  $\text{OH}\cdot\text{SO}\langle\begin{smallmatrix}\text{N}\cdot\text{SO}(\text{OH}) \\ \text{N}\cdot\text{SO}(\text{OH})\end{smallmatrix}\rangle\text{N}$ , is crystalline, but the yield is extremely small, and the analytical results do not agree with those required for the pure compound; it may be, however, that it contains combined water. It crystallises from methyl alcohol in colourless, glistening needles, melts at about  $161^\circ$ , is odourless, but has a sharp, acid taste, dissolves in alcohol, and also sparingly in ether, but is insoluble in benzene or chloroform. Aqueous solutions are fairly stable, except when warmed. Ebullioscopic determinations of the molecular weight in ethyl acetate solution point to the formula  $(\text{SO}_2\cdot\text{NH})_3$ . The values obtained for the molecular conductivities of trisulphimide and its salts in aqueous solution show (1) that trisulphimide behaves as a strong acid; (2) that it is tribasic. Further, the conductivity of the potassium salt is nearly the same as that of potassium ferricyanide. The molecular conductivity of silver trisulphimide is much lower than that of potassium trisulphimide at the same dilution.

*Pyridine silver trisulphimide*,  $(\text{SO}_2\text{N})_3\text{Ag}_3\cdot 6\text{C}_5\text{NH}_5$ , crystallises in prisms and is gradually decomposed at  $140^\circ$ . The *N-methyl* derivative,  $\text{SO}_2\langle\begin{smallmatrix}\text{NMe}\cdot\text{SO}_2 \\ \text{NMe}\cdot\text{SO}_2\end{smallmatrix}\rangle\text{NMe}$ , obtained from the silver salt, forms colourless crystals melting at  $121^\circ$  and readily soluble in most organic solvents. It is not hydrolysed by alkalis and only very slowly by acids, yielding methylamine and sulphuric acid. *Tribenzoylsulphimide*,  $(\text{SO}_2\text{N}\cdot\text{COPh})_3$ , crystallises in prisms melting at  $112^\circ$ . J. J. S.

**Isomorphism of Selenates and Tellurates.** By JAMES F. NORRIS and WILLIAM A. KINGMAN (*Amer. Chem. J.*, 1901, 26, 318—324).—The authors have attempted to prepare isomorphous selenates and tellurates, but without success. All the tellurates except those of the alkali metals are insoluble and the soluble tellurates do not resemble the corresponding selenates in crystalline form, solubility, or amount of water of crystallisation.

*Rubidium hydrogen tellurate*,  $\text{RbHTeO}_4\cdot\frac{1}{2}\text{H}_2\text{O}$ , is a crystalline salt, soluble in about 20 parts of cold water, and slightly more so in hot water. The *cæsium* salt,  $\text{CsHTeO}_4\cdot\frac{1}{2}\text{H}_2\text{O}$ , forms small, cubic crystals and is soluble in about 30 parts of cold water.

*Rubidium hydrogen selenate*,  $\text{RbHSeO}_4$ , is a hygroscopic, well crystallised salt, which dissolves in about its own weight of water. The *cæsium* salt,  $\text{CsHSeO}_4$ , crystallises in large, flat plates with pointed ends and is extremely hygroscopic.

*Rubidium tellurate*,  $\text{Rb}_3\text{TeO}_4\cdot 3\text{H}_2\text{O}$ , crystallises in prisms with pyramidal ends and is soluble in about 10 parts of water. E. G.

**Aqueous Ammonia Solutions.** By FRANZ GOLDSCHMIDT (*Zeit. anorg. Chem.*, 1901, 28, 97—139).—The partial pressure and the conductivity of ammonia solutions (0.5*N*, 0.75*N*, and 1*N*) were determined and the same constants for solutions to which carbamide (1*N* and 1.5*N*) had been added. The vapour tension was measured by the method previously used by Gaus (*Abstr.*, 1901, ii, 7). The increase of the partial pressure of the ammonia is almost exactly proportional to the amount of carbamide added. The values of *k* found from the expression

$(k + \text{H}_2\text{O})/(k + \text{H}_2\text{O}') = \lambda^2 p' / \lambda'^2 p$  is negative and almost exactly constant;  $k$  is the hydration constant,  $\text{H}_2\text{O}$  the active mass of the water (taken as 100),  $\text{H}_2\text{O}'$  the active mass after the addition of the carbamide,  $\lambda$  and  $\lambda'$  are the conductivities, and  $p$  and  $p'$  the ammonia partial pressures of the solutions with and without the carbamide. The variation of the active mass of the water is taken as proportional to the variation of the vapour pressure, on the assumption that only a monohydroxide is formed. No significance can be attributed to the fact that the value of  $k$  is negative.

From the conductivity of ammonia solutions (which show a maximum molecular conductivity), it is found that the dissociation constant ( $K$ ) varies from  $22.1 \times 10^{-6}$  to  $0.23 \times 10^{-6}$  for solutions which are 0.0109  $N$  to 12.89  $N$ . As the solution becomes dilute, the value of  $K$  approaches a constant, and assuming that this begins at the concentration 0.02  $N$ , the value of  $K$  is  $19.1 \times 10^{-6}$ . The inconstancy of the values of  $K$  cannot be attributed to the formation of complex ions such as  $\text{NH}_4 \cdot \text{NH}_3$ ; for the lowering of the freezing point of water containing ammonia and ammonium salts corresponds with the value calculated for the quantity of material added.

The addition of ammonia diminishes the conductivity of aqueous salt solutions. The diminution is directly proportional to the quantity of ammonia added and amounts to 2 to 3 per cent. of the value of the conductivity per gram-mol. of ammonia per litre. Lithium salts are most affected in this way by ammonia, sodium salts less so, and potassium salts least. The action of ammonia is independent of the nature of the anion present. It is concluded that the speed of migration of the ions is reduced by the presence of ammonia, and this is also proved thermodynamically.

The influence of ammonia on the conductivity of ammonium chloride, mono-, di-, and tri-methylamine hydrochloride and piperidine hydrochloride is of the same nature as, but much smaller than, that on the alkali salts; with tetramethylammonium chloride, the effect is of the same magnitude as with potassium nitrate. J. McC.

Chemical Equilibrium in the Reduction of Nitric Acid by means of Nitric Oxide. By A. V. SAPOSCHNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1901, 33, 506—516. Compare Abstr., 1900, ii, 722).—The author's previous experiments (*loc. cit.*) on the decomposition of nitrous acid according to the equation,  $3\text{HNO}_2 = \text{HNO}_3 + 2\text{NO} + \text{H}_2\text{O}$ , having failed to yield the equilibrium constant of the reaction, he has now studied the inverse change, the method of experiment being to pass nitric oxide through nitric acid of a certain strength and to determine from time to time the electrical conductivity of the solution. At the end of each experiment, the amount of nitrous and nitric acids and of nitric oxide in the liquid was determined. On calculating the constants of equilibrium for acids of varying concentration from the formula,  $K = c^3/x^2c_1^2$ , where  $c$  and  $c_1$  are the concentrations of the nitrous and nitric acids respectively in the final solution, and  $x$  the degree of dissociation of the nitric acid, it is found that for nitric acids of  $N$  to  $N/10$  initial concentration, the constant ( $\times 10,000$ ) varies within the limits 142 and 178 and has a mean value of 159; for

acid of 0.05*N* concentration, the constant is 232, the high value being probably due to the fact that at such great dilution the reaction proceeds very slowly and possibly does not reach its final point; with acids of higher concentration than normal, the constant falls regularly, a behaviour probably explained by the final product of the reaction consisting partly of oxides of nitrogen mixed with the nitrous acid. The coefficient of absorption of nitric oxide in litres of gas per litre of acid is given for each different nitric acid employed; Kahlbaum's acid, having a sp. gr. 1.517 at 15°/4°, contains 0.88 per cent. of nitric oxide, the coefficient of absorption in this case being 12.5. The speed of the absorption of nitric oxide by nitric acid varies to a very large extent with the concentration of the acid, as is shown by curves connecting litres of the gas absorbed with time in hours. T. H. P.

**Allotropy of Phosphorus.** By RUDOLF WEGSCHEIDER and FELIX KAUFLEDER (*Monatsh.*, 1901, 22, 700—706).—Red and yellow phosphorus may be either polymorphous or chemically different (isomeric or polymeric). If the two forms are polymorphous, the liquid forms must be identical, and molten yellow phosphorus or a concentrated solution should, on addition of red phosphorus (which is the stable form), change into the latter. Experiments show that such is not the case. A saturated solution of yellow phosphorus in carbon disulphide sown with red phosphorus shows no perceptible change, and, on lowering the temperature, yellow phosphorus separates. Similar molten yellow phosphorus at 200°, to which red phosphorus has been added, does not change. The two forms are not polymorphous, but chemically different.

K. J. P. O.

**Metaphosphates.** By ARTHUR WEISLER (*Zeit. anorg. Chem.*, 1901, 28, 177—209).—Sodium trimetaphosphate, when prepared according to Fleitmann's and Henneberg's methods, and when prepared from sodium hydrogen phosphate and ammonium nitrate according to Knorre's method (*Abstr.*, 1900, ii, 651), has an electrical conductivity which indicates that it is a salt of a tribasic acid. The trimetaphosphate, in aqueous solution (1/32*N*), is not altered by boiling; neither orthophosphate nor pyrophosphate is formed.

Barium, manganese, and silver trimetaphosphates are described; of these the manganese salt has an electrical conductivity corresponding with that required for a salt of a tribasic acid. The other two salts are too insoluble for the determination of their electrical conductivities.

Copper trimetaphosphate could not be obtained from sodium trimetaphosphate, the product being a pyrophosphate of the formula  $\text{Cu}_2\text{P}_2\text{O}_7 \cdot 5\text{H}_2\text{O}$ . In the case of zinc, a sodium zinc pyrophosphate is produced. The sodium cadmium trimetaphosphate,  $\text{CdNa}_4(\text{PO}_3)_3 \cdot 4\text{H}_2\text{O}$ , is obtained by adding cadmium iodide to the sodium salt.

Sodium hexametaphosphate, prepared from sodium pyrophosphate according to Knorre's method (*Zeit. angew. Chem.*, 1892, 641), has an electric conductivity  $\lambda_{32} = 31.2$ , which is evidence that the salt has a more complicated composition than the trimetaphosphate ( $\lambda_{32} = 89.4$ ). The hexametaphosphate is easily decomposed in aqueous solution and when heated at 40° yields the pyrophosphate. E. C. R.



**Chemical Reactions produced by Radium.** By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1901, 133, 659—664).—The radiations from radium decompose iodic acid, with liberation of iodine, and also decompose nitric acid, the changes in both cases being endothermic. They do not, however, promote the oxidation of oxalic acid, or the conversion of sulphur into the variety insoluble in carbon disulphide, nor do they, like the silent electric discharge, cause the polymerisation of acetylene. The author confirms the statement that the rays gradually turn glass black, a change which he attributes to the reduction of lead compounds to the metallic state, and has also observed the production of a violet colour similar to that produced by the action of light on certain glasses containing manganese. It would seem, therefore, that the radiations cause a reduction and an oxidation simultaneously, and possibly the one change is consequent on the other.

C. H. B.

**Action of Bromine on Metallic Silver in the Light and in Darkness.** By V. VON CORDIER (*Monatsh.*, 1901, 22, 707—716. Compare Abstr., 1900, ii, 343, 723).—By use of a specially constructed apparatus, the action of bromine on metallic silver illuminated by an arc lamp, an incandescent gas lamp, or diffused daylight, and in darkness was investigated. Whilst light assists the combination of silver and chlorine (*loc. cit.*), it hinders that of silver and bromine. Bromine is not given off in the light from silver bromide in the presence of carbon dioxide.

K. J. P. O.

**Action of Hydrogen Peroxide on Silver Oxide.** By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1901, 133, 555—569).—The author has investigated in the calorimeter the action of several acids on (1) silver oxide, and (2) silver oxide which had been treated with hydrogen peroxide. The development of heat differs considerably in the two cases, both in rate and amount, and the results, which are described in detail, confirm the author's previous conclusions as to the formation of a higher oxide of silver (Abstr., 1899, ii, 149).

C. H. B.

**Reduction of Copper by Solutions of Ferrous Salts.** By H. C. BIDDLE (*Amer. Chem. J.*, 1901, 26, 377—382).—The precipitation of copper by solutions of ferrous salts is a reversible action, the direction of which in any case is determined by the relative concentration of the ferrous, ferric, and copper (cuprous and cupric) ions. This statement is justified by the following experimental evidence. In a solution containing an appreciable quantity of ferric ions, or in which these would be formed in the course of the reaction, copper is not deposited; this is shown by the fact that ferrous chloride and sulphate are incapable of reducing the corresponding copper salts. In a solution containing a few ferric ions, and in which the reaction does not cause an appreciable increase of them, a sufficient concentration of ferrous and copper ions will produce the deposition of copper. The tendency of ferrous salts to reduce those of copper is shown by the precipitation of cuprous thiocyanate when ammonium thiocyanate is

added to a solution of ferrous and cupric chlorides. From a mixture of ferrous and cupric hydroxides, crystals of cuprous oxide slowly separate. When an excess of ammonium carbonate is added to a solution of ferrous and cupric chlorides, a yellow liquid is obtained which gradually deposits a mirror of metallic copper. If a solution of cupric and ferrous chlorides is treated with sodium carbonate in slight excess or with potassium hydrogen carbonate, reduction slowly takes place with loss of carbon dioxide and formation of basic ferric carbonate and copper. E. G.

**Mixed Crystals of Copper Sulphate and Zinc Sulphate.** By H. W. FOOTE (*Amer. Chem. J.*, 1901, 26, 418—428).—It is well known that from solutions of copper sulphate containing zinc sulphate an isomorphous mixture of triclinic crystals separates consisting of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  together with a smaller quantity of  $\text{ZnSO}_4 \cdot 5\text{H}_2\text{O}$ . As the quantity of zinc sulphate is increased in the solution, an isomorphous mixture of monoclinic crystals is obtained containing  $\text{CuSO}_4 \cdot 7\text{H}_2\text{O}$  and  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ , and in presence of a still larger proportion of zinc sulphate, rhombic crystals of  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$  with a small amount of  $\text{CuSO}_4 \cdot 7\text{H}_2\text{O}$  are produced. It has been shown by van't Hoff, from theoretical considerations, that the composition of mixed crystals at their 'mixing limit' (which represents the composition of mixed crystals of one salt with a maximum of another) ought to be a function of the temperature; the same conclusion is arrived at by application of the phase rule.

The authors have carried out experiments on the 'mixing limit' of copper sulphate and zinc sulphate at 12°, 25°, 35°, 40°, and 45°, which confirm the accuracy of the above assumption, and also show that whilst the composition of mixed crystals varies with the temperature, the salts mentioned do not form completely isomorphous crystals between 12° and 56°. It is also found that in solutions yielding two forms of crystals, the amount of copper sulphate in solution remains nearly constant, whilst the quantity of zinc sulphate increases considerably with rising temperature. E. G.

**Cuprous Chloride.** By MAX GRÖGER (*Zeit. anorg. Chem.*, 1901, 28, 154—161).—When cuprous chloride is treated with water in an atmosphere of hydrogen or carbon dioxide, the chlorine passes almost completely into solution and a dark red residue, consisting of cuprous oxide and copper, is left. The separation of the copper is due to the action of light, for when the extraction is carried out in the dark the residue is almost pure cuprous oxide. Water acting on cuprous chloride in presence of a little air gives an orange-red residue of cuprous oxide mixed with about 5 per cent. of basic cupric chloride. The amount of cupric compound left in the residue is always small, showing that most of the oxidation product of the cuprous chloride passes into solution. By the action of water and air sufficient for the complete oxidation, a residue was obtained which had the composition  $3\text{CuO} \cdot \text{CuCl}_2 \cdot 4\text{H}_2\text{O}$ . The primary action is the hydrolysis of the cuprous chloride, and the liberated hydrochloric acid, in presence of oxygen, acts upon more cuprous chloride forming the cupric com-

pound. Secondly, the cupric chloride reacts with the cuprous oxide (hydrolytic product) forming cuprous chloride again and basic cupric chloride.

Very dilute hydrochloric acid in an atmosphere of carbon dioxide changes the colour of cuprous chloride through green, almost black, to a dark copper brown. The residue in this case consists of metallic copper formed by the decomposition  $\text{Cu}_2\text{Cl}_2 = \text{Cu} + \text{CuCl}_2$ ; but as copper is deposited on the cuprous chloride it protects this from total decomposition. Cuprous chloride in a solution of cupric chloride, when protected from the action of the air, remains perfectly white even in sunlight, showing that cupric chloride prevents the direct decomposition of the cuprous compound.

Perfectly dry cuprous chloride remains unchanged in the air and light has no effect upon it.

The method recommended for the preparation of cuprous chloride is to dissolve 42 grams of cupric chloride in 200 c.c. of hydrochloric acid of sp. gr. 1.175 and 100 c.c. of water, and heat the solution with copper foil on the water-bath until it is decolorised. The solution is then poured into 2 litres of water, the precipitate filtered (in diffused light) and washed, first with dilute sulphuric acid (1 : 20), then with absolute alcohol, drained as dry as possible on the pump and dried quickly in the water-oven.

J. McC.

**Mercury Oxychlorides.** By N. TARUGI (*Gazzetta*, 1901, 31, ii, 313—320).—The author has examined the various oxychlorides of mercury described by different authors, and finds that, without exception, they consist of mixtures, in indefinite proportions, of mercuric oxide and chloride. The three compounds described below are therefore the first oxychlorides of mercury obtained.

The *oxychloride*,  $\text{HgCl}_2 \cdot 3\text{HgO}$ , is obtained by adding small cubes of perfectly white statuary marble of a sugar-like structure into saturated aqueous mercuric chloride at 15°. After remaining for 15—20 days in diffused light, the liquid deposits the oxychloride in small, yellow crystals which continue to increase in number and size, and are separated, washed with water, and dried in a vacuum. When heated or when boiled with water or alkali solution, the oxychloride decomposes into its constituents, whilst dilute nitric acid converts it into a white, amorphous powder.

If the saturated mercuric chloride solution is diluted with twice its volume of water and treated as before, an *oxychloride* of the formula  $\text{HgCl}_2 \cdot 2\text{HgO}$ , is obtained in very thin, black crystals; whilst if three volumes of water are added to the saturated mercuric chloride solution, a *compound* of the composition  $\text{HgCl}_2 \cdot \text{HgO}$ , is produced in very thin, red crystals. These two oxychlorides have the same chemical properties as the first described.

T. H. P.

**Alkali Double Nitrites of Mercury and Zinc.** By ARTHUR ROSENHEIM and KURT OPPENHEIM (*Zeit. anorg. Chem.*, 1901, 28, 171—174).—Mercuric nitrate, when treated with a concentrated solution of potassium nitrite, dissolves and the solution becomes warm. Mercuric oxide separates out and from the filtrate yellow crystals



of *potassium mercury nitrite* of the composition  $K_3Hg(NO_2)_5 \cdot H_2O$  are deposited. The salt crystallises in rhombic forms [ $a:b:c = 0.8594:1:0.7581$ ] and is soluble in cold water without decomposition.

If the solution of this salt contains a slight excess of potassium nitrite, ill-defined crystals of the compound  $KHg(NO_2)_3$  are formed.

*Sodium mercury nitrite*,  $Na_2Hg(NO_2)_4$ , has been prepared by recrystallising the product obtained by the action of a concentrated solution of sodium nitrite on mercuric nitrate.

*Potassium zinc nitrite*,  $K_3Zn(NO_2)_5 \cdot 3H_2O$  is produced when nitrous acid is passed into a solution of potassium nitrite containing zinc hydroxide in suspension. It forms very hygroscopic, yellow crystals.

J. McC.

**Copper-Aluminium Alloys.** By LÉON GUILLET (*Compt. rend.*, 1901, 133, 684—686).—The author has prepared various copper aluminium alloys by heating pure cupric oxide with granular aluminium in proportions varying from those which should yield pure copper to those which should yield the alloy  $CuAl_4$ . By treating the products with acids, he has isolated three distinctly crystalline, definite alloys,  $Cu_3Al$ ,  $CuAl_2$ , and  $CuAl$ , the last being mixed with a small quantity of copper aluminium silicide.

C. H. B.

**Compounds of Aluminium Bromide with Bromine and Carbon Disulphide.** II. By WLADIMIR A. PLOTNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1901, 33, 429—432. Compare Abstr., 1901, ii, 316).—The compound of the composition  $AlBr_3 \cdot Br_4 \cdot CS_2$ , previously described (*loc. cit.*) by the author as obtained by the action of bromine on a carbon disulphide solution of aluminium bromide, is only formed when the bromine is employed in excess. If, however, to a well-cooled solution of aluminium bromide (1 mol.) in carbon disulphide a quantity of bromine not greater than 1 atomic proportion is added slowly in drops, an almost theoretical yield of an oily compound is obtained, having the composition  $2AlBr_3 \cdot Br_4 \cdot CS_2$ . When left in a warm place or when shaken repeatedly with carbon disulphide, the oil deposits a brownish, crystalline mass, which, when dry, melts at about  $80^\circ$  and begins to dissociate into aluminium bromide and  $CS_2Br_4$  at about  $100^\circ$ ; dissociation also occurs under the influence of even traces of moisture. The compound is soluble in ether or benzene.

T. H. P.

**The Reduction of Alumina by Calcium Carbide.** By SAMUEL A. TUCKER and HERBERT R. MOODY (*J. Soc. Chem. Ind.*, 1901, 20, 970—971).—In the electric furnace, aluminium oxide is not reduced by carbon, but if lime is added calcium carbide is formed and this reduces the alumina. Calcium carbide reduces alumina and the yield of aluminium is increased by the presence of free carbon. The heat should not be applied longer than 15 minutes, for after that time aluminium carbide is formed.

J. McC.

**Periodic System and the Properties of Inorganic Compounds.** III. The Solubility of Alums as a Function of Two Variables. By JAMES LOCKE (*Amer. Chem. J.*, 1901, 26, 332—345).—The author

has previously determined the solubility at  $25^{\circ}$  of the alums of aluminium, vanadium, chromium and iron severally with ammonium, thallium, rubidium and caesium (Abstr., 1901, ii, 656). When the solubilities of these 16 compounds expressed in gram-mols. per litre of water are plotted as a function of the atomic weights of the trivalent metals, a figure of remarkable regularity is obtained, from a consideration of which it is evident that the lines joining the solubility points of the successive univalent metals with two given trivalent metals have approximately a common point of intersection. It must be assumed, therefore, that the points representing the solubilities stand in fixed mathematical relation to one another. Hence it is shown that if the difference in the solubility of the alums of a given trivalent metal with two alkali metals is termed "the increment of solubility for the latter," the general law is obtained that "the ratio between the increments of solubility of the corresponding alums of two trivalent metals for any two alkali metals is constant." The accuracy of this law is fully confirmed by observation. A general equation for the solubility of any of the sixteen alums is deduced from this law, all the terms of which can be referred to two variables, one applying to the trivalent element in the compound, and the other to the univalent metal. Determinations made at other temperatures than  $25^{\circ}$  indicate that it will be possible to derive a general solubility formula for all temperatures.

E. G.

**The Reaction of Sodium Thiosulphate with Potassium Permanganate.** By A. ÅLANDER (*Zeit. anal. Chem.*, 1901, 40, 574—577).—Both qualitative and quantitative proofs are given that in alkaline solutions the reaction  $8\text{KMnO}_4 + 3\text{Na}_2\text{S}_2\text{O}_3 = 3\text{Na}_2\text{SO}_4 + 3\text{K}_2\text{SO}_4 + 8\text{MnO}_2 + \text{K}_2\text{O}$  is the principal one, but that a small quantity of the thiosulphate (about 1.3 per cent.) is oxidised only to tetrathionate.

M. J. S.

**Separation of Iron.** By PAUL NICOLARDOT (*Compt. rend.*, 1901, 133, 686—688).—When ferric chloride is heated at  $125^{\circ}$  it is converted into a complex compound in which the ratio of iron to chlorine is 1 : 1, whilst the corresponding sulphate is insoluble. The iron alloy (1 gram) or compound is dissolved in aqua regia, the nitric acid expelled, and the liquid evaporated to dryness and heated at  $125^{\circ}$  for 4 hours. It is then diluted with water to 500 c.c., heated to boiling, and about 1 gram of ammonium sulphate added. After boiling for about 15 minutes, the very finely divided precipitate is filtered off. If mercury or cadmium is present, the substance cannot be heated at  $125^{\circ}$  without loss, and therefore the liquid is exactly neutralised with ammonia, mixed with ammonium sulphate, boiled, and filtered. It is again mixed with ammonia until a slight precipitate is formed and again boiled, when the whole of the iron is precipitated. Selenates, phosphates, arsenates, vanadates, and molybdates precipitate iron in a similar manner, and the iron is readily separated from the precipitate by fusion with an oxidising mixture or an alkali.

C. H. B.

**Ferric Oxide and Hydroxides.** By OTTO RUFF (*Ber.*, 1901, 34, 3417—3430. Compare Tommasi, *Ber.*, 1879, 12, 1929, 2334).—The red, colloidal ferric hydroxide may be converted into true hydrates

by the aid of considerable pressure under water. At a temperature of  $42.5^\circ$ , it yields brown ironstone, at  $42.5$ — $62.5^\circ$ , göthite, and at higher temperatures, hydrohaematite. Yellow ferric hydroxide is not a true colloid, as its percentage of water under high pressure does not vary between temperatures of  $40^\circ$  and  $70^\circ$ .

The red hydroxide appears to lose water at the ordinary atmospheric temperature and pressure and, at the same time, but somewhat more slowly, takes up water and becomes converted into brown ironstone, the only stable hydrate under ordinary conditions. J. J. S.

**Influence of the Separation of Sulphur on the Precipitation of Iron Salts.** By A. COPPADORO (*Gazzetta*, 1901, 31, ii, 217—221).—When hydrogen sulphide is passed through an acidified solution of a ferric salt, a precipitate of sulphur is formed containing small quantities of iron compounds, which the most exhaustive washing is incapable of removing. By dissolving the sulphur from the dried precipitate by means of carbon disulphide, however, the author has succeeded in determining the amount of iron enclosed in the precipitate. He finds that the quantity of iron is proportional to that of the ferric salt taken and to that of the precipitated sulphur, but is independent of the amount of acid added to the solution and of the time during which the hydrogen sulphide is kept passing through the liquid. If a precipitate of sulphur is produced in a solution of a ferrous salt, for example, by the addition of thiosulphate and acid, the precipitate is found to contain iron. The author suggests that possibly the presence of iron in these precipitates is connected with Graham's observation that when solutions of two colloids are mixed they are precipitated together. T. H. P.

**Crystallographic Examination of some Luteocobaltic Salts.** By TIMOTHÉE KLOBB (*Chem. Centr.*, 1901, ii, 970; from *Bull. Soc. franç. Min.*, 24, 307—322. Compare Abstr., 1901, ii, 103).—Luteocobaltic selenate,  $\text{Co}(\text{NH}_3)_6(\text{SeO}_4)_3 \cdot 5\text{H}_2\text{O}$ , prepared by neutralising luteocobaltic hydroxide with selenic acid and slowly evaporating the solution, separates in thick, brownish-yellow, monoclinic crystals [ $a : b : c = 1.1350 : 1 : 1.4023$ .  $ac = 90^\circ 35'$ ]. Luteocobaltic sulphate,  $\text{Co}(\text{NH}_3)_6(\text{SO}_4)_3 \cdot 5\text{H}_2\text{O}$ , forms lustrous, monoclinic crystals [ $a : b : c = 1.1230 : 1 : 1.4143$ .  $ac = 90^\circ 18'$ ]. Luteocobaltic hydrogen sulphate,  $2\text{Co}(\text{NH}_3)_6(\text{SO}_4)_3 \cdot 5\text{H}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ , obtained by adding sulphuric acid to an aqueous solution of the normal salt, crystallises in small, rhombic octahedra [ $a : b : c = 0.99913 : 1 : 1.0006$ ] and is decomposed by water. Luteocobaltic hydrogen selenate,  $\text{Co}(\text{NH}_3)_6(\text{SeO}_4)_3 \cdot \text{H}_2\text{SeO}_4 \cdot 5\text{H}_2\text{O}$ , prepared by adding excess of selenic acid to luteocobaltic hydroxide or to the normal selenate, crystallises in triclinic crystals, often twinned [ $a : b : c = 0.84550 : 1 : 0.47285$ .  $bc = 88^\circ 50'$ ,  $ac = 80^\circ 50'$ ,  $ab = 86^\circ 47'$ ], and is not decomposed by water. Luteocobaltic chlorosulphate, obtained from cobalt chloride or sulphate or by treating luteocobaltic chloride with sulphuric acid or a sulphate, is rhombic [ $a : b : c = 0.99855 : 1 : 1.0538$ ]. Luteocobaltic chloroselenate is rhombic [ $a : b : c = 0.99869 : 1 : 1.0563$ ]. Luteocobaltic ammonium sulphate,  $[\text{Co}(\text{NH}_3)_6]_2(\text{SO}_4)_3 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 8\text{H}_2\text{O}$ , prepared by crystallising luteocobaltic sulphate in presence of ammonia,

separates in rhombic octahedra or thick plates. When moistened with water, the crystals become opaque, but in concentrated ammonium sulphate solution they remain transparent and ultimately dissolve. Luteocobaltic ammonium selenate,  $[\text{Co}(\text{NH}_3)_6]_2(\text{SeO}_4)_3 \cdot (\text{NH}_4)_2\text{SeO}_4 \cdot 8\text{H}_2\text{O}$ , obtained by neutralising a solution of luteocobaltic hydrogen selenate with ammonia, is isomorphous with the preceding salt [ $a:b:c = 0.95953:1:1.2024$ ]. After the separation of this hydrate, a hydrate crystallising with  $4\text{H}_2\text{O}$  crystallises out in large, monoclinic prisms [ $a:b:c = 1.4285:1:0.64688$ .  $ac = 94^\circ 42'$ ]. Luteocobaltic chloroammonium sulphate,  $[\text{Co}(\text{NH}_3)_6]_4(\text{SO}_4)_3\text{Cl}_2 \cdot 3(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$ , prepared by evaporating a solution of luteocobaltic chlorosulphate with an excess of ammonium sulphate, crystallises in octahedra and is decomposed by water.

E. W. W.

**Crystallographic Study of Alvisi's Luteocobaltiammine Perchlorates.** By FEDERICO MILLOSEVICH (*Gazzetta*, 1901, 31, ii, 285).—Luteocobaltiammonium diperchlorate chloride,  $\text{Co}(\text{NH}_3)_6\text{Cl}(\text{ClO}_4)_2$ , forms rhombohedral, orange-yellow crystals,  $\alpha = 70^\circ 41'$ .

Luteocobaltiammonium perchlorate,  $\text{Co}(\text{NH}_3)_6(\text{ClO}_4)_3$ , gives orange-yellow crystals of the cubic system.

T. H. P.

**Researches on Perchlorates. Luteocobaltiammine Perchlorates and Observations on Metallo-Ammoniums. I.** By Ugo ALVISI (*Gazzetta*, 1901, 31, ii, 289—301).—The author has prepared various luteocobaltiammine perchlorates and gives the methods used by him for their analysis.

*Luteocobaltiammonium diperchlorate chloride*,  $\text{Co}(\text{NH}_3)_6\text{Cl}(\text{ClO}_4)_2$ , prepared by the interaction of cold saturated solutions of ammonium perchlorate (3 mols.) and luteocobaltiammine chloride (1 mol.), crystallises from water in hexagonal, yellow plates having a pearly lustre; when rapidly heated, it gradually loses ammonia, and at about  $188^\circ$  explodes, water vapour, chlorine, and nitrogen being evolved and cobalt oxide and chlorides left.

*Luteocobaltiammonium perchlorate*,  $\text{Co}(\text{NH}_3)_6(\text{ClO}_4)_3$  is prepared (1) by heating aqueous cobalt perchlorate with excess of ammonium perchlorate and ammonia and adding potassium (or better sodium) permanganate until the liquid assumes an intense, golden-yellow coloration; or (2) by heating a solution of cobalt perchlorate with lead dioxide, ammonia, and excess of ammonium perchlorate until the filtered liquid becomes intensely orange-yellow in colour. It crystallises from water in orange-yellow octahedra belonging to the cubic system and with hydrochloric acid yields the diperchlorate chloride just described.

Theoretical considerations are put forward by the author as to the mode of combination of nitrogen in the cobaltiammonium compounds with the other elements present.

T. H. P.

**Cause of the Brown Coloration of Ammonium Sulphide in Presence of a Nickel Salt.** By UBALDO ANTONY and G. MAGRI (*Gazzetta*, 1901, 31, ii, 265—274).—When hydrogen sulphide or ammonium polysulphide solution is added to an ammoniacal solution



of nickel acetate in quantity insufficient to precipitate all the nickel as sulphide, the precipitate obtained has the composition  $\text{NiS}$ , and in the latter case is mixed with sulphur. When, however, an excess of ammonium polysulphide is added to an ammoniacal nickel solution, the precipitate formed is of very variable composition but the dark liquid always contains a sulphide of the composition  $\text{NiS}_4$ . This sulphide, which is obtained as a black powder, is only slightly attacked by hydrochloric acid but reacts vigorously with nitric acid, sulphur being liberated. In an atmosphere of carbon dioxide, it loses sulphur at  $300^\circ$ , being converted into nickel sulphide, whilst when heated in water in presence of air it slowly oxidises, giving nickel sulphate and sulphuric acid. Hydrogen sulphide solution has no action on it, but it is dissolved by a solution of sulphur or ammonium polysulphides giving a brown liquid. With ammonia solution, it yields an azure-blue liquid containing nickel, but all the sulphur is deposited in a very fine state of division. Measurements of the electrical conductivity of solutions of nickel tetrasulphide in ammonium sulphide show that the nickel salt is not present in a state of true solution or in a really colloidal condition, the author regarding it as existing in an intermediate state.

T. H. P.

**Action of Sodium Thiosulphate on certain Metallic Salts.** By FRANZ FAKTOR (*Chem. Centr.*, 1901, ii, 878; from *Pharm. Post*, 34, 485—487. Compare Abstr., 1900, ii, 598, 627, 688, 691, and 692).—Ammonium molybdate is reduced by a solution of sodium thiosulphate, forming molybdenum trioxide and the hydrate of the dioxide,  $\text{MoO}_3 \cdot 3\text{H}_2\text{O}$ , whilst sodium tungstate, when warmed with sodium thiosulphate and a small quantity of nitric acid, yields tungsten dioxide, trioxide, and heptoxide. By the action of sodium thiosulphate on uranyl nitrate, a yellow precipitate of *uranyl thiosulphate*,  $\text{UO}_2\text{S}_2\text{O}_3$ , is formed; the thiosulphate, on ignition, yields the green oxide,  $\text{U}_3\text{O}_8$ . *Beryllium thiosulphate*,  $\text{BeS}_2\text{O}_3 \cdot 11\text{H}_2\text{O}$ , is prepared from sodium thiosulphate and beryllium sulphate. Quinone is reduced by sodium thiosulphate, forming first quinhidrone and then quinol. By the action of sodium thiosulphate and hydrogen dioxide on manganese salts, a brown precipitate of manganese hydroxide is obtained; when treated in the same way, chromates are reduced to chromic hydroxide, cobalt salts give a black and nickel salts a pale green precipitate.

E. W. W.

**Two Phosphorus-Molybdenum Compounds.** By F. MAWROW (*Zeit. anorg. Chem.*, 1901, 28, 162—166).—On addition of hypophosphorous acid to a solution of ammonium molybdate in concentrated hydrochloric acid, a bluish-green solution is produced and a violet deposit with a coppery lustre obtained. This deposit is soluble in cold water, giving a green solution, which, on exposure to air, becomes blue. It is decomposed by alkali, forming a green precipitate. It is soluble in concentrated sulphuric acid with a blue colour, and on dilution a yellowish brown precipitate is formed. Heated on platinum foil, it explodes and leaves a grey residue. Its composition can be represented by  $\text{Mo}_5\text{O}_8(\text{H}_3\text{PO}_2)_7 \cdot 3\text{H}_2\text{O}$ .

On heating an aqueous solution of this, it becomes blue and on evaporating at  $90$ — $95^\circ$  a blue residue is obtained which is soluble in

water or alcohol with a blue colour and explodes when heated. Its composition is represented by  $\text{Mo}_5\text{O}_{13}(\text{H}_3\text{PO}_2)_3, \text{H}_2\text{O}$ . Both these compounds are strong reducing agents, indicating that the phosphorus is present in the condition of hypophosphorous acid. It is doubtful if the formulæ given are correct, but it is certain that the substances are not compounds of molybdic acid, but of a lower oxide of molybdenum.

The blue solution gives characteristic precipitates with salts of ammonium, barium, lead, and bismuth. J. McC.

**Behaviour of Hydrochloric Acid Solutions of Metastannic Acid towards Hydrogen Sulphide.** By GUNNER JÖRGENSEN (*Zeit. anorg. Chem.*, 1901, 28, 140—153).—Hydrogen sulphide gives with hydrochloric acid solutions of metastannic acid, precipitates which vary in composition according to the concentration of the hydrogen sulphide, the concentration of the hydrochloric acid, the temperature, and the time. At first, the precipitate consists for the greater part of metastannic acid mixed with a small quantity of stannic sulphide. When kept, the precipitate absorbs hydrogen sulphide slowly and only after a very long time (two months) does the composition correspond with that of stannic sulphide. Increase of the concentration of metastannic acid, or of hydrogen sulphide, or rise of temperature lead to an increase in the proportion of stannic sulphide formed. Increase of the concentration of hydrochloric acid diminishes the absorption of hydrogen sulphide. The rate of formation of the stannic sulphide is extremely slow and it decreases to a far greater extent than the law of mass action would indicate; this is possibly due to the formation of soluble thiostannate ions. J. McC.

**Thiocyanates of Quadrivalent Titanium.** By ARTHUR ROSENHEIM and ROBERT COHN (*Zeit. anorg. Chem.*, 1901, 28, 167—170). Compare this vol., ii, 244).—Thiocyanic acid solution dissolves large quantities of titanic acid, and on evaporation of the saturated solution in a vacuum over sulphuric acid a brownish-red, crystalline powder is obtained which is soluble in cold water, exhibits the reactions of thiocyanates, and possesses all the properties of a titanium salt. It has the composition  $\text{TiO}(\text{SCN})_2, 2\text{H}_2\text{O}$ .

A solution of titanic acid in thiocyanic acid, when mixed with potassium thiocyanate and evaporated over sulphuric acid, gives hygroscopic, deep red, rhombic crystals of  $\text{K}_3\text{TiO}(\text{SCN})_4, \text{H}_2\text{O}$ . This is soluble in cold water, but on standing it is decomposed with decolorisation. The corresponding ammonium, sodium, and barium salts have been obtained, but not quite pure.

The pyridine compound,  $(\text{C}_5\text{NH}_5)_2\text{H}_2\text{TiO}(\text{SCN})_4$ , as a purple precipitate, is obtained when a concentrated hydrochloric acid solution of pyridine in alcohol is added to a solution of thiocyanic and titanic acids. The precipitate can be recrystallised from the mother liquor and is then obtained in well-defined, bluish-black crystals.

The quinoline salt,  $(\text{C}_9\text{NH}_7)_2\text{H}_2\text{TiO}(\text{SCN})_4, 4\text{H}_2\text{O}$ , can be prepared in the same way. By recrystallisation from the mother liquor, it separates in deep red crystals, which could not be obtained pure but are probably anhydrous. J. McC.



**Fluorovanadium Compounds.** By PETR G. MELIKOFF and P. KASANEZKY (*Zeit. anorg. Chem.*, 1901, 28, 242—254).—Potassium vanadium dioxyfluoride,  $\text{VO}_2\text{F}_2\cdot 2\text{KF}$ , when treated with successive portions of hydrogen peroxide, behaves like a compound of the constitution  $\text{VF}_3(\text{KO})_2$ . The fluorine is gradually replaced by oxygen, and orange to red crystalline compounds are obtained containing successively less fluorine, the final product of the reaction being pervanadate. The corresponding ammonium salt reacts in a similar manner.

E. C. R.

**Preparation of Pure Stibine.** By KARL OLSZEWSKI (*Ber.*, 1901, 34, 3592—3593).—With reference to the statements of Stock and Doht (*Abstr.*, 1901, ii, 556), the author points out that the phenomenon previously observed by him (*Abstr.*, 1886, 977) was a decomposition, not a dissociation, of liquid stibine, and that in his experiments air had access to the liquid. Stibine boils at about  $-18^\circ$ , probably somewhat lower than this.

A. H.

**Gold Haloids.** By FELIX LENGFELD (*Amer. Chem. J.*, 1901, 26, 324—332).—Aurous chloride is insoluble in water and dilute nitric acid, and is decomposed by strong nitric acid with production of auric chloride and gold. When nitric acid is added to an ammoniacal solution of the salt, a white, curdy, unstable precipitate is formed. If aurous chloride is added to solution of potassium bromide, gold separates, and a brownish-red liquid is obtained, containing potassium aurichloride and auribromide. It dissolves in a solution of sodium chloride with formation of an unstable double salt, probably  $\text{NaAuCl}_2$ .

Aurous bromide is insoluble in water and nitric or sulphuric acid, but dissolves in ammonia with partial decomposition; on addition of nitric acid to the ammoniacal solution, an unstable precipitate is produced. Potassium cyanide dissolves the salt without decomposition. Potassium bromide yields potassium auribromide and gold. With hydrobromic or hydrochloric acid, it is converted into bromoauric or chloroauric acid and gold. Both aurous chloride and bromide are slowly decomposed by ether, alcohol, or acetone.

Auroso-auric bromide (aurous auribromide), obtained by the action of bromine on gold, is a steel-blue substance, stable in the absence of water, but easily decomposed by water and many organic solvents.

Chloroauric and bromoauric acids form the compounds  $\text{HAuCl}_4\cdot 3\text{H}_2\text{O}$ ,  $\text{HAuBr}_4\cdot 3\text{H}_2\text{O}$ , and  $\text{HAuBr}_4\cdot 6\text{H}_2\text{O}$ , but the compounds  $\text{HAuCl}_4\cdot 4\text{H}_2\text{O}$  and  $\text{HAuBr}_4\cdot 5\text{H}_2\text{O}$  probably do not exist.

When solutions of chloroauric acid and silver nitrate are mixed at  $0^\circ$ , a yellow precipitate is formed which rapidly darkens and decomposes. If an alcoholic solution of potassium aurichloride is shaken with silver carbonate, silver chloride and auric chloride are produced.

E. G.

## Mineralogical Chemistry.

**Fusibility of Minerals and their Solubility in Magmas.** By CORNELIUS DOELTER (*Chem. Centr.*, 1901, ii, 826—827; from *Tsch. Min. Mitth.*, 1901, 20, 307—330).—The results are given of detailed observations of the manner in which various minerals are attacked by molten magmas. As a rule, minerals with a very high melting point (quartz, corundum, olivine, leucite) are more sparingly soluble than those with a lower melting point (felspar, augite, mica). In general, however, the solubility of a mineral in a magma depends on the pressure, the temperature, and the chemical composition of the magma, as well as on the fusibility of the particular mineral. L. J. S.

**Retinite from Thessaly.** By CONSTANTIN ZENGELIS (*Chem. Centr.*, 1901, ii, 833; from *Tsch. Min. Mitth.*, 1901, 20, 356).—This retinite is yellowish-red, almost opaque, hard and readily combustible, sp. gr. 1.0023. At 290°, it softens and fuses with decomposition. Benzene dissolves 17.4 per cent. The following analysis corresponds with that required for the formula  $C_{10}H_{14}O$ :

C.	H.	S.	O.	Ash.	Moisture.
78.47	9.23	0.39	10.616	1.47	0.214

L. J. S.

**Calaverite.** By SAMUEL L. PENFIELD and W. E. FORD (*Amer. J. Sci.*, 1901, [iv], 12, 225—246. Compare Abstr., 1896, ii, 31).—A detailed crystallographic account is given of crystals of calaverite from Cripple Creek, Colorado. They are interpreted as being monoclinic and elongated in the direction of the axis of symmetry, but the faces have very high indices and do not fall into zones. The axial ratios,  $a:b:c = 1.6313:1:1.1449$ , axial angle,  $\beta = 89^\circ 47' \frac{1}{3}$ , and, twinning, resemble those of sylvanite, but calaverite differs from this mineral in having no distinct cleavage. The general formula  $(Au, Ag)Te_2$  expresses the chemical composition of both calaverite and sylvanite, but the latter contains more silver, and its formula approximates to  $AuAgTe_4$ . The following analyses are given of the material now described:

Au.	Ag.	Te.	Gangue.	Total.	Sp. gr.
40.99	1.74	[57.25]	0.02	100.00	9.328
42.77	0.40	[56.75]	0.08	100.00	9.388

The colour of the brightest calaverite crystals is silver-white, sometimes with a yellowish cast; it is not bronze-yellow as often described.

L. J. S.

**Monazite from New Granada.** By NICHOLAS J. BLUMAN (*Chem. News*, 1901, 84, 175).—A sample of reddish-brown colour, sp. gr. 6.001 and hardness 5, gave the following numbers on analysis:

$Ce_2O_3$ .	$La_2O_3$ .	$ThO_2$ .	MnO.	CaO.	$SnO_2$ .	$P_2O_5$ .	Fe, Zn, S.	Total.
25.02	22.41	18.00	1.21	2.13	3.00	28.23	traces	100.00

D. A. L.

Triplite from Moravia and its Decomposition Products. By FRANTIŠEK KOVÁŘ and FR. SLAVÍK (*Jahrb. Min.*, 1901, i, Ref., 354—356; from *Verh. geol. Reichsanst.*, 1900, 397—404. Compare Abstr., 1901, ii, 248).—Cleavage masses of triplite, more or less altered, occur in large nests in pegmatite at Wien and Cyrillhof in Moravia. The optical characters and the following analyses are given: I and II are of weathered material from Wien, sp. gr. 3·901; calculating the iron as ferrous, these agree with the usual formula,  $(\text{Mn}, \text{Fe}, \text{Mg})_2\text{PO}_4(\text{F}, \text{OH})$ . III is of fairly fresh material and IV of much weathered material from Cyrillhof; the latter decomposes hydrochloric acid with the liberation of much chlorine.

Further alteration of the material results in the formation of a cellular mass of dufrenite and hydroxides of iron and manganese with a colourless hydrated phosphate of iron and manganese: analysis of this mixture gave VI. The dufrenite, separated as far as possible from the other substances, gave V, agreeing with the usual formula  $\text{Fe}_2(\text{OH})_3\text{PO}_4$ . The insoluble residue is shown by analysis and microscopical examination to consist of quartz, felspar and muscovite.

	I.	II.	III.	IV.	V.	VI.
$\text{Fe}_2\text{O}_3$ .....	2·80	4·26	7·78	37·08	56·69	5·56
$\text{FeO}$ .....	26·10	24·31	33·37	—	—	41·80
$\text{Mn}_2\text{O}_3$ .....	—	—	—	16·24	1·48	—
$\text{MnO}$ .....	29·17	29·85	17·92	—	—	2·87
$\text{Al}_2\text{O}_3$ .....	—	—	—	0·35	0·36	0·13
$\text{CaO}$ .....	0·49	0·56	1·27	1·68	0·60	0·47
$\text{MgO}$ .....	4·58	4·74	0·40	0·56	0·23	0·12
Alkalis .....	—	—	0·19	0·63	—	—
$\text{P}_2\text{O}_5$ .....	31·67	30·89	32·44	17·56	29·02	31·31
$\text{CO}_2$ .....	trace	0·59	—	—	—	—
$\text{H}_2\text{O}$ .....	4·16	4·20	4·48	13·68	9·85	11·36
F .....	1·11	trace	0·88	—	—	—
Insol. ....	0·84	0·35	2·37	13·35	2·19	7·26
Total (less O for F).	100·45	99·75	100·73	101·13	100·42	100·88

The first stage in the alteration of the triplite is the replacement of fluorine by hydroxyl with the formation of triploidite. This is then oxidised and decomposed with the separation of hydroxides of iron and manganese along cracks, and finally yields the mixture of dufrenite, &c. Near the nests of triplite, the quartz of the pegmatite is represented only by empty cavities, and it is suggested that this mineral has been removed by the fluorine set free on the alteration of the triplite.

L. J. S.

Emerald and Beryl from the Uralian Emerald Mines. By PETR A. ZEMJATSCHENSKY (*Jahrb. Min.*, 1901, ii, Ref., 190—191; from *Trav. Soc. Nat. St. Petersburg*, 1900, 29, 1—19).—The emerald mines on the Takowaja river, 85 versts north-east of Ekaterinburg, have, since 1832, yielded fair amounts of emerald, beryl, phenakite and alexandrite. The emeralds are embedded in a dark mica-schist, or

occur, intergrown with tourmaline and felspar, in masses of quartz and felspar in the mica-schist; they are usually cloudy and enclose scales of mica, whilst along the frequent fractures felspar is deposited. The crystals have a zonal structure and are optically anomalous. Analyses I—III are of pale colour emerald, and IV—V of the dark brown mica in which they are embedded.

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	BeO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	Mn <sub>2</sub> O <sub>4</sub> .	Loss on ignition.	Total.
I.	66·65	18·43	trace	12·9	—	—	—	—	2·19	100·17
II.	66·96	18·58	—	13·1	—	—	—	—	2·1	100·74
III.	65·95	18·95	trace	12·89	—	—	—	—	2·20	99·99
IV.	40·20	26·22	13·31	—	6·69	10·44	0·87	trace	1·81	99·55
V.	40·12	26·19	13·50	—	6·10	10·23	0·80	—	1·87	98·81

L. J. S.

**Minerals from the Ilmen Mountains.** By P. SUSCHTSCHINSKY (*Jahrb. Min.*, 1901, i, Ref., 361—363; ii, Ref., 205—206; from *Trav. Soc. Nat. St. Petersburg*, 1900, 29, 21—46).—Minerals from the æschynite, aquamarine and zircon mines, near Miask, are described. Aquamarine gave, on analysis, the results under I. Black, rhombic dodecahedra of garnet in mica-slate gave II. Dark green crystals of ægirine-augite from druses in gneiss gave III (anal. by Antipoff).

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	BeO.	CaO.	MgO.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Total.
I.	66·02	18·81	—	—	13·27	—	—	—	1·45	99·55
II.	35·34	19·51	—	40·20	—	4·91	—	—	—	99·96
III.	50·58	5·47	3·92	23·18	—	3·85	2·19	8·17	—	97·36

L. J. S.

**Composition of Plagioclase.** By W. TARASSENKO (*Jahrb. Min.*, 1901, ii, Ref., 180—189; from *Mem. Nat. Soc. Kieff* [*Russ.*], 1900, 16, 365—496. Compare Abstr., 1900, ii, 354).—The plagioclase of labradorite-rocks from (I) Selitsche (Gov. Volhynia) and (II) Gorodistsche (Gov. Kieff) was separated into several portions according to sp. gr. and each portion examined in detail. The eleven analyses, of which the means are given below, differ among themselves for each felspar only within the limits of errors of observation. The variation in the sp. gr. is attributed to the porosity of the material, due to the presence of fluid enclosures, cleavage cracks, &c.

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	CaO.	Na <sub>2</sub> O.	K <sub>2</sub> O.	Sp. gr.	Formula.
I.	55·28	28·27	10·18	5·17	1·10	2·647—2·710	Ab <sub>1</sub> An <sub>1</sub>
II.	53·05	29·77	12·08	4·30	0·80	2·697—2·756	Ab <sub>2</sub> An <sub>3</sub>

It is concluded that the plagioclases are not isomorphous mixtures, but compounds of the albite and anorthite molecules in definite proportions.

L. J. S.

**Sodalite from Viterbo.** By FERRUCCIO ZAMBONINI (*Jahrb. Min.*, 1901, ii, Ref., 19; from *Riv. Min. Crist. Ital.*, 1900, 24, 13).—Small crystals of sodalite from an "erratic block" at S. Sisto, near Viterbo, gave, on analysis:

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	Na <sub>2</sub> O.	CaO.	Cl.	Total (less H <sub>2</sub> O. O for Cl).
36·60	34·26	1·85	17·75	0·90	4·31	99·84

L. J. S.



[Amphibole in] Soda-syenite from Miask. By ARRIEN JOHNSEN (*Jahrb. Min.*, 1901, ii, 117—127).—Descriptions are given of five rocks of the soda-syenite group from Miask in the Urals. One of these, called an ægirine-augite-soda-syenite, consists of albite, a little microcline, ægirine-augite, and a peculiar amphibole. This amphibole is pleochroic and has a wide angle of optical extinction ( $\epsilon:c=36^\circ$ ); sp. gr. 3·15; an approximate analysis gave the following results:

SiO <sub>2</sub> (+TiO <sub>2</sub> ?).	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	MnO.	MgO.	CaO.
58·50	12·38	14·32	4·79	3·16	4·30	0·92
	Na <sub>2</sub> O.	K <sub>2</sub> O.	Total.			
	4·09	0·48	102·94			

It appears to be intermediate between riebeckite and glaucophane.

L. J. S.

Andalusite from the Rhætian Alps. By AUGUST GRAMANN (*Jahrb. Min.*, 1901, ii, Ref., 193—197; from separate publ. Zürich, 1899, 57 pp.).—At several localities in the Flüela and Scaletta districts in Switzerland, crystals of andalusite occur with cordierite, kyanite, sillimanite, muscovite, biotite, orthoclase, pericline, &c., in quartz lenticles in biotite-gneiss, but not in the gneiss itself. The sp. gr. of the andalusite is lower than usual, being 3·0532—3·0829. The colour is peach-blossom-red or violet, and the crystals have sometimes a darker coloured kernel. The colouring matter appears to be TiO<sub>2</sub> (rutile) rather than Ti<sub>2</sub>O<sub>3</sub>. The extremes of five analyses are:

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> (+FeO).	Fe <sub>2</sub> O <sub>3</sub> .	H <sub>2</sub> O.
33·76—34·71	63·93—64·69	Nil—0·44	0·49—1·78

The alteration product of the andalusite is a white, scaly, sericitic material containing much quartz and carbonates. By the aggregation of numerous scales of this secondary sericite, large plates of muscovite are formed, analysis of which gave the following results, agreeing with those required for the formula 4H<sub>2</sub>O, K<sub>2</sub>O, (Ca, Mg)O, 6Al<sub>2</sub>O<sub>3</sub>, 10SiO<sub>2</sub>:

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	MgO.	CaO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Total.
43·09	42·16	0·29	2·54	6·79	trace.	5·11	99·98

L. J. S.

Fire-clay from Moravia. By FRANTIŠEK KOVÁŘ and ANT. HAŠKOVEC (*Jahrb. Min.*, 1901, ii, Ref., 226; from *Zeit. chem. Ind. Prag*, 1899, 3 pp.).—Beds of fire-clay occur in the Quader sandstone at Vranová near Kunstadt. Analysis I is of whitish, and II, of dark greyish, more sandy, material.

SiO <sub>2</sub> .	TiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	CaO.	MgO.	Alkalis.	SO <sub>3</sub> .	Loss on ignition.	Total.
I. 52·42	trace	33·56	1·17	0·77	0·38	1·28	—	10·84	100·42
II. 52·11	0·17	27·73	5·92	0·91	0·57	1·07	0·21	12·78	100·47

L. J. S.

**Separation of Titaniferous Iron Ores in Basic Igneous Rocks** By JOHAN H. L. VOGT (*Chem. Centr.*, 1901, ii, 829; from *Zeit. prakt. Geol.*, 1901, 289—296. Compare Abstr., 1900, ii, 63; 1901, ii, 319).—A graphic representation of analyses shows that as concentration takes place, a decrease in silica is accompanied by a decrease in alumina and alkalis and an increase in titanium and iron oxides, while the variations in the lime show no regularity. Very advanced stages in the differentiation cannot be explained by a simple addition or subtraction of material, since, with varying conditions, the processes of differentiation are more or less changed as they proceed. In all probability, the differentiation is effected by the transference of a dissolved constituent in a solvent; the former being the bulk of the titanium and iron oxides and magnesia, and the latter a part of the silica with alumina, lime, and alkalis. The materials are concentrated in the same order in which they crystallise out from the magma, namely: (1) apatite; (2) sulphides; (3) titanium and iron oxides with spinel; (4) ferromagnesian silicates. Cases are, however, known in which all of these may be concentrated together. L. J. S.

**A South Australian Meteorite.** By GEORGE A. GOYDER (*Trans. Roy. Soc. South Australia*, 1901, 25, 14).—This iron, of which the weight is  $7\frac{1}{2}$  lbs., shows Widmanstätten figures and twin-lamellæ (Neumann lines) on the etched surface and consists of blades of kamacite with thin plates of tænite and grains of troilite. Analysis by W. S. Chapman gave:

Fe.	Ni.	Co.	S.	P.	Insol.	Total.	Sp. gr.
88.85	9.07	0.34	0.75	0.27	0.03	99.31	7.693

L. J. S.

**Analysis of the Sulphurous Waters of Vernet-les-Bains.** By LÉON FERRER (*J. Pharm. Chim.*, 1901, [vi], 14, 385—389).—The waters of Vernet-les-Bains belong to the class of thermal sulphuretted alkaline waters. Complete analyses of samples from seven different springs are given in the paper. H. R. LE S.

## Physiological Chemistry.

**Artificial Parthenogenesis.** By S. J. HUNTER (*Amer. J. Physiol.*, 1901, 6, 177—180).—The experiments were made on the eggs of *Arbacia*, and show that sea water concentrated by evaporation will produce the formation of imperfect larvæ. This is regarded as confirming Loeb's osmotic theory of artificial parthenogenesis.

W. D. H.

**Influence of Spermatotoxin on Reproduction.** By MDLLE. C. DE LESLIE (*Compt. rend.*, 1901, 133, 544—546).—On injecting into the white male rat spermatotoxic serum from the guinea pig, it loses all



power of reproduction. The sterility lasts for 16—20 days. Sterility may be similarly produced in the female. The injection does not otherwise influence the well being of the animals; the males even continue to produce mobile spermatozoa; these, however, have lost their power of fertilisation.

W. D. H.

**Quantitative Observations on Gastric Digestion.** By FRIEDRICH KRÜGER (*Zeit. Biol.*, 1901, 41, 467—483. Compare Abstr., 1901, ii, 561).—The general belief that the action of pepsin, like that of other enzymes, is inhibited by the presence of digestive products is well founded. The addition of peptone to the mixture lessens the digestive action. Tables are given which show that the inhibitory action of the digestive products is proportional to their quantity, provided the amount of hydrochloric acid is kept constant; in ordinary digestion, this is not the case; the loss of power is greater and is to be in part explained by diminution in the amount of free acid. The amount of free hydrochloric acid which is most favourable is from 0.18 to 0.4 per cent.

W. D. H.

**Blood Analysis in Relation to Metabolism.** By G. ASCOLI (*Pflüger's Archiv*, 1901, 87, 103—115).—It is pointed out that in studying metabolism, the examination of the excreta alone does not teach the details of the metabolic cycle. Intermediate stages, especially in relation to nitrogenous metabolism in the organs, should be searched for, by the examination of the blood for such substances as purine compounds, carbamic acid, creatine, &c.

W. D. H.

**Influence of Sodium Nitrate on Metabolism in Dogs.** By E. ROST (*Chem. Centr.*, 1901, ii, 864; from *Arbb. Kais. Ges.-A.*, 18, 78—99).—Small doses of sodium nitrate have practically no effect on metabolism. Large doses given in water produce diuresis and a 'nitrogen-sparing' action. If insufficient water is given, there is an increase of proteid katabolism. Among different sodium salts, the carbonate produces the greatest increase in the breakdown of proteid material in the body.

W. D. H.

[Proteid Metabolism in Inanition.] By ERWIN VOIT (*Zeit. Biol.*, 1901, 41, 502—549; 550—571).—These two papers are largely critical. The main conclusion arrived at is that proteid katabolism in starvation is largely influenced by the amount of reserve and circulating fat in the body. When the quantity of fat is large, no increase of proteid disintegration occurs, but when it sinks below a certain limit, disintegration begins. Length of life during starvation therefore depends largely on the amount of fat to start with. Death is due, not to destruction of the total cell-masses of the body, but on katabolic changes in a few organs of essential importance.

The second paper deals at greater length with the influence of fat on proteid katabolism.

W. D. H.

**Rôle of Purine Derivatives in Human Metabolism.** By RICHARD BURIAN and HEINRICH SCHUR (*Pflüger's Archiv*, 1901, 87, 239—354. Compare Abstr., 1900, ii, 489).—In birds, uric acid is

the main end-product of nitrogenous metabolism. In mammals, the question is a debatable one whether the uric acid and other purine derivatives which these animals excrete are to be regarded as terminal or intermediate products. A full and critical review of the extensive literature on the subject shows how diverse are the views which are held. The purine derivatives of the urine have a double origin, *exogenous* from the nuclein and purine compounds of the food, and *endogenous* from tissue metabolism. The problem is complicated by the fact that the organism not only forms purine compounds, but it also has the power of destroying them. This property is especially possessed by the liver, so that the excretion of purine compounds is no measure of the amount found unless at the same time the amount destroyed is also known. The relationship between the two processes can be ascertained by the injection of known quantities of purine compounds either into the blood stream or subcutaneously. Such experiments show mainly the fate of exogenous purine, but endogenous purine is apparently acted on in the same way. The result of the experiments shows that uric acid and purine derivatives are in the main intermediate products of metabolism, but that a certain fraction of these intermediate products is excreted as such by the kidneys. This fraction varies in different animals, but in animals of the same class the integration factor (that is, the number by which the urinary purine must be multiplied in order to obtain the total) is very constant; in carnivora it is 20—30, in the rabbit 6, in man 2; that is, in man, half the uric acid formed is excreted in the urine. W. D. H.

**Amount of Fluorine in Teeth and Bones.** By JODLBAUER [with JOSEF BRANDL] (*Zeit. Biol.*, 1901, 41, 487—492).—Hempel's method of estimating fluorine in bone and teeth gives more trustworthy figures than that of Wöhler-Eresenius. W. D. H.

**Compounds of Mercury and Arsenic in the Liver.** By B. SLOWTZOFF (*Beitr. chem. Physiol. Path.*, 1901, 1, 281—288).—When arsenic is given to animals and accumulates in the liver, it unites with the nuclein, and after gastric digestion is found in the precipitate of nuclein. Mercury, on the other hand, unites with the globulin constituents of the cell-protoplasm. W. D. H.

**Composition of the Fat in Young Children.** By F. SIEGERT (*Beitr. chem. Physiol. Path.*, 1901, 1, 183—188).—Langer (Abstr., 1882, 240) originally stated that the amount of solid fatty acids in the subcutaneous fat of new-born children is relatively great, and that with growth oleic acid increases. This statement has not been confirmed by all subsequent observers (Thiemich, Abstr., 1899, ii, 234). In the present research, a large number of observations is recorded; the mean iodine number for new-born children is 43·36; in successive months, the number is 42·5, 46·9, 47·5, 53·2, 45·5, 49·9, 48·9, 54·75, 58·55, until at 12 months it rises to 62·35, the number for the adult being 65. W. D. H.

**Behaviour of Fat during Autolysis of the Liver.** By F. SIEGERT (*Beitr. chem. Physiol. Path.*, 1901, 1, 114—120).—Four

experiments were made with dogs' livers. The amount of ethereal extract and of higher fatty acids was estimated before and after autolysis (from 7 to 9 days, putrefaction being prevented). The amounts of both are practically the same before and after autolysis.

W. D. H.

**Autolysis and Blood-clotting.** By H. CONRADI (*Beitr. chem. Physiol. Path.* 1901, 1, 136—182).—The juices expressed from various animal organs without exception hasten blood-clotting. After autolysis, the same organs yield solutions which hinder blood-clotting. Both substances are soluble in water and precipitable by alcohol; the one which favours coagulation is rendered inert by boiling, is not diffusible, does not filter through a Chamberland filter, and is rendered still more active by calcium chloride. The substance which hinders coagulation is not influenced by heat or by calcium chloride, diffuses readily, and passes partially through a Chamberland filter. The blood itself when kept also gives rise to this substance. It appears to be analogous to peptozyme.

W. D. H.

**Formation of Bactericidal Substances in Autolysis.** By H. CONRADI (*Beitr. chem. Physiol. Path.*, 1901, 1, 193—228).—Bactericidal power is absent from the juices expressed from fresh organs as a rule. It is present in the juice from lymph glands and slightly in that from the spleen. After autolysis, the expressed juice of muscle, liver, spleen, lymph glands, testis, thymus, suprarenal body and duodenum is strongly bactericidal. The juice from bone marrow, ovary, lung, tonsil, kidney, jejunum and ileum has the same power to a less degree. It is absent in the juice after autolysis from foetal intestine, pancreas, thyroid, submaxillary gland, and brain. The bactericidal substances are hydrolytic decomposition products of proteids, and from their reactions and solubilities are probably derived from the aromatic complex of the proteid molecule. They give Millon's, the xanthoproteic, and bromine reactions. They are soluble in alcohol and are precipitated from their alcoholic solutions by ether.

W. D. H.

**Function of Brunner's Glands.** By KARL GLAESSNER (*Beitr. chem. Physiol. Path.*, 1901, 1, 105—113).—The fluid obtained by autolysis of the mucous membrane of the small intestine has certain digestive powers. If a portion is taken which contains both Brunner's and Lieberkühn's glands, the action is both proteolytic and diastatic. If there are only Lieberkühn's follicles, proteolytic power is absent. If the upper part of the duodenum is taken and the surface layer containing Lieberkühn's follicles removed and only Brunner's glands left, the diastatic power is absent. Inverting action on cane sugar, and emulsifying action on fats were absent throughout. The proteolytic enzyme of the Brunner's glands acts in weakly alkaline, neutral, and feebly acid solutions; it is regarded as identical with the enzyme, separated from the pyloric end of the stomach, which the author has named pseudopepsin.

W. D. H.

**Gluco-proteids of Lower Animals.** By OTTO VON FÜRTH (*Beitr. chem. Physiol. Path.*, 1901, 1, 252—258.)—The gluco-proteid of the egg

covers of sepia, or of the ground substance of chondrosia were investigated. The reducing substance obtained in each case was an amino-sugar of the type of glucosamine. W. D. H.

**Nucleo-histon.** By IVAR BANG (*Beitr. chem. Physiol. Path.*, 1901, 1, 189—192).—Further reasons are advanced which bear out the author's previous contention that nucleo-histon in the sense of Lilienfeld and Kossel does not exist. W. D. H.

**Formation and Secretion of Chymosin (Rennin).** By ALEXANDER WINOGRADOFF (*Pflüger's Archiv*, 1901, 87, 170—228).—There is an inverse proportion between the quantity of rennet ferment and time of coagulation. A method is described for estimating the amount of the ferment. The ferment is believed to participate in the regeneration of proteid from peptone, and the results obtained by estimating its power of forming plastein are identical with those obtained in experiments on milk. After a meal, the formation of rennin by the gastric mucous membrane increases from the first to the ninth hour; there are two maxima, namely, from the second to the fifth, and from the ninth to the eleventh hour. Even after this time, the ferment is still secreted in small quantities. The amount in the gastric juice is proportional to that in the mucous membrane and very closely follows the curve of pepsin formation. W. D. H.

**Tyrosinase in Animals.** By OTTO VON FÜRTH and HUGO SCHNEIDER (*Beitr. chem. Physiol. Path.*, 1901, 1, 229—242).—Tyrosinase is an enzyme, described by Bertrand as occurring in the juices of certain plants (*Abstr.*, 1896, ii, 571), which oxidises tyrosine and leads to the darkening of the juice. It is apparently analogous to the lac-case of certain other plants. It has been found by Biedermann (*Abstr.*, 1898, ii, 614) in the intestine of the meal worm. The present research shows that it is a constant constituent of the blood of insects and other arthropods, and is the cause of the darkening of the blood on exposure to the air. The chemical nature of the chromogen in the blood is left uncertain; it is, however, not tyrosine. The melanin formed contains C, 55.44; H, 4.45; N, 13.74; it is believed to be related to the indole group, but its chemical nature is also left uncertain. W. D. H.

**Excretion of Uric Acid.** By HELLMUTH ULRICI (*Chem. Centr.*, 1901, ii, 1024—1025; from *Arch. exp. Path. Pharm.*, 46, 321—337).—Sodium benzoate increases the excretion of uric acid. Gallic acid acts in the same way. Quinic acid and tannin have no influence on metabolism or the excretion of uric acid. Salicylic acid produces a great stimulation of metabolic processes, increases the total output of nitrogen, and especially raises that of uric acid; this is followed by a diminution in the excretion of the acid. W. D. H.

**Physiological Action of Chloral Hydrate and Acetone.** By C. ARCHANGELSKY (*Chem. Centr.*, 1901, ii, 1028—1029; from *Arch. exp. Path. Pharm.*, 46, 347—371).—A method of estimating chloral



hydrate in the blood and tissues is described. In dogs, 0.03 to 0.05 per cent. in the blood causes narcosis; 0.05 to 0.07 abolishes the corneal reflex; and 0.11 to 0.12 causes cessation of breathing; in the rabbit, rather larger doses are necessary. In the blood, most of the chloral is present in the corpuscles; at first, the brain contains less than the blood; that in the liver remains small, but the brain tissue which is believed to have a special affinity for chloral hydrate soon contains much more than the blood.

Acetone in the blood to the extent of 0.5 per cent. causes narcosis; it is chiefly present in the corpuscles. The brain contains more, the liver less, than the blood. The central nervous system has also a special affinity for this drug. Both narcotics are believed to be united to the fatty constituents of protoplasm.

W. D. H.

**Acid Poisoning in Dog and Rabbit.** By KARL SPIRO (*Beitr. chem. Physiol. Path.*, 1901, 1, 269—280).—Many previous observers have pointed out that carnivora are less susceptible to the toxic influence of acids than herbivora, and some have attributed this to a fundamental difference between the animals, the carnivora, by production of ammonia, being able to neutralise the acid. It is now pointed out that the difference, although it exists, is only a quantitative one, and that acids and acid phosphates stimulate the kidney to increased activity in the dog more than in the rabbit; the dog thus rapidly eliminates the harmful material. Other diuretics (caffeine and its homologues) also act more powerfully on the dog's kidney than on that of the rabbit; the dog's kidney, moreover, has a higher resistance towards poisonous substances.

W. D. H.

**Condition of the Blood and Marrow in Chronic Arsenical Poisoning.** By I. C. MUIR (*J. Pathol. Bacteriol.*, 1901, 7, 420—446).—In chronic arsenical poisoning in man, the blood is richer in red corpuscles and hæmoglobin when there is deep cutaneous pigmentation than when the skin is but slightly pigmented. Pigmentation is not due to destruction of hæmoglobin, but melanin may be a precursor of hæmoglobin. Arsenic stimulates the erythroblastic action of red marrow, especially when the skin has a store of melanin in it.

W. D. H.

**Behaviour of Calcium Hypophosphite [when administered internally].** By MASSOL and GAMEL (*J. Pharm. Chim.*, 1901, [vi], 14, 337—342).—Contrary to the usually accepted statements, it is definitely shown from the results of experiments carried out on dogs, that when calcium hypophosphite is administered internally, the hypophosphite is not oxidised to phosphate, but is entirely eliminated by the urine as sodium hypophosphite, and that the calcium is eliminated by the fæces. The volume of urine, the total nitrogen, and the amount of urea are not changed, but the acidity of the urine, the amount of uric acid, and the ratio of uric acid to urea are diminished. Complete analyses of the urine, before and after treatment, are given in the original paper.

H. R. LE S.



**Antagonism of Curare and Physostigmine.** By JULIUS C. ROTHBERGER (*Pflüger's Archiv*, 1901, 87, 117—169).—Bilateral antagonism exists between curare and physostigmine so far as their action on muscles is concerned. Those muscles which, like the diaphragm, are last paralysed by curare, are first set free again by the injection of physostigmine. Physostigmine also stimulates the respiratory centre. There is no antagonism between the two drugs *in vitro*.  
W. D. H.

**Action of Fluorescent Materials on Ciliated Epithelium.** By RICHARD JACOBSON (*Zeit. Biol.*, 1901, 41, 444—466).—Light increases the poisonous action of fluorescent substances on ciliated epithelium. Non-fluorescent poisonous substances act equally vigorously in light and darkness. Non-poisonous fluorescent substances act in the same way in light and darkness.  
W. D. H.

**Chemical Action of the Microsporon Audouini.** By W. D'ESTE EMERY (*J. Pathol. Bacteriol.*, 1901, 7, 400—408).—It has been surmised that the ringworm fungus (*Microsporon audouini*) has the power of digesting keratin. This view is not confirmed. The fungus, however, secretes a proteolytic enzyme which finds its proteid pabulum near the hair bulbs, and the action of which is to set up slight folliculitis; the loss of hair is in part due to this, and in part to splitting caused by mechanical pressure.  
W. D. H.

**Phloridzin Diabetes in Cats.** By JULIUS F. ARTEAGA (*Amer. J. Physiol.*, 1901, 6, 173—176).—In the fasting cat, just as in the rabbit and goat, the urinary ratio between dextrose and nitrogen in phloridzin diabetes is 2.8 : 1, a striking example of biological uniformity.  
W. D. H.

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## Chemistry of Vegetable Physiology and Agriculture.

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**Assimilation of Free Nitrogen by Soil Bacteria without Symbiosis with Leguminosæ.** By JULIUS KÜHN (*Bied. Centr.*, 1901, 30, 660—663; from *Fühling's Landw. Zeit.*, 1901, 2).—The results of field experiments on rye during 21 years show that the yields of grain and straw on the unmanured plot and on the plot which has had only non-nitrogenous manures tend to increase rather than diminish. The soil evidently contains fair amounts of available mineral matter, whilst experiments with nitrogenous manure indicate a limited supply of available nitrogen. The conclusion is therefore drawn that fixation of elementary nitrogen is going on under the influence of soil organisms.

Krüger has isolated a micro-organism from the soil, which, in cultivations in artificial solutions, assimilated not inconsiderable amounts of free nitrogen.

The yield of rye on the different plots was as follows (kilos. per hectare):

	1879.		1894—1898.		1899.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
1. Dung .....	2400	3870	2774	5696	2405	5565
2. Minerals .....	1770	2520	1976	4363	1640	4020
3. „ + ammonium sulphate + nitrate.....	2570	4080	2926	5968	2675	5950
4. Ammonium sulphate + nitrate .....	2560	3570	2664	5224	2370	5030
5. Unmanured .....	1820	2490	1974	3914	1750	3730

The season of 1899 was unfavourable to grain production.

N. H. J. M.

**Decomposition of Nitrates and Nitrites by Bacteria.** By ALBERT MAASSEN (*Chem. Centr.*, 1901, ii, 820—821; from *Arb. k. Ges.-A.*, 18, 1—77).—Potassium nitrate in 0·5 per cent. solutions containing peptone (5 per cent.) was reduced to nitrite by 85 of the 109 varieties of microbes examined. Fifty varieties destroyed nitrites, four of them liberating free nitrogen. Many bacteria which reduced nitrites, without liberation of nitrogen, had very little or no effect on nitrates. The presence of carbohydrates is favourable to denitrification, whilst in absence of organic nitrogen, nitrates and nitrites are attacked by microbes which have no effect when proteids are present.

The so-called denitrifying organisms destroy nitrates independently of the nature of the nutritive solutions, whilst the others act only in presence of certain carbon compounds. The action of both classes of microbes is retarded by the presence of highly oxygenated compounds, such as chlorates, without injury to their growth.

Some bacteria, such as *Bacterium praepollens*, act on nitrates only in symbiosis with other varieties, liberating nitrogen and producing potassium carbonate. The co-operating bacteria, in the case of *B. praepollens*, are exclusively those which reduce nitrates to nitrites.

N. H. J. M.

**Decompositions of Nitrogen Compounds in Soil by Lower Organisms.** By W. KRÜGER and W. SCHNEIDEWIND (*Chem. Centr.*, 1901, ii, 824—825; from *Landw. Jahrb.*, 30, 633—648. Compare *Abstr.*, 1901, ii, 470).—Application of straw, in field experiments, resulted in a lessened assimilation of nitrogen and a diminished crop. The injurious effect of fresh organic matter on the assimilation of nitrogen by the crop is to a great extent due to production of insoluble nitrogenous compounds, under the influence of denitrifying and other microbes and fungi. The nitrogen not only of nitrates but especially of ammonium salts and amides becomes unavailable. The insoluble nitrogen becomes available only slowly; most of it, perhaps, not at all.

Ammonium sulphate (but not nitric nitrogen) is partly converted into proteids even in absence of fresh organic manure. This explains why ammonium salts supply less nitrogen to crops than nitrates when the latter are not subjected to loss by drainage.

N. H. J. M.

**Effect of Methylal on some Fresh-water Algæ.** By RAOUL BOUILHAC (*Compt. rend.*, 1901, 133, 751—753).—*Nostoc* and *Anabaena* are able to grow in presence of methylal when the amount of light is insufficient for the decomposition of carbon dioxide; in absence of methylal or other organic matter, there is no growth under these conditions. A certain amount of light is necessary when methylal is present.

Experiments are proposed to ascertain whether methyl alcohol and formaldehyde respectively can replace methylal. N. H. J. M.

**Constituents of Coffee Berries.** By L. GRAF (*Zeit. angew. Chem.*, 1901, 14, 1077—1082).—Coffee berries do not contain dextrose or any reducing sugars in the free state. The presence of sucrose in the methyl alcoholic extract has been established. It appears that sucrose after crystallisation from methyl alcohol melts at 169—170°, but after crystallisation from ethyl alcohol at 179—180°.

Caffetannic acid is also a constituent of coffee beans; although generally regarded as a glucoside, it does not yield a sugar on treatment with dilute acids, concentrated alkali, bromine or dilute nitric acid (compare Kunz-Krause, *Abstr.*, 1893, ii, 327; 1897, i, 530; F. Koch, *ibid.*, 1895, ii, 410; Hlasiwetz, *Annalen*, 1867, 142, 219; Cazeneuve and Haddon, *Abstr.*, 1897, i, 529). J. J. S.

**Presence of Salicylic Acid in Strawberries. Errors of Analysis which may result therefrom.** By L. PORTES and A. DESMOULIÈRES (*J. Pharm. Chim.*, 1901, [vi], 14, 342—351).—Salicylic acid has been actually isolated from ten different varieties of strawberries, and is shown to be a normal constituent of this fruit. The acid is most probably present as methyl salicylate. The amount present, although small, 1 mg. having been obtained from 1 kilogram of the fruit, is sufficient to answer to the reactions employed for the detection of salicylic acid in cases of suspected adulteration. H. R. LE S.

**Formation of the Perfume of Vanilla.** By HENRI LECOMTE (*Compt. rend.* 1901, 133, 745—748).—The fruit of *Vanilla planifolia* does not possess the characteristic odour of vanilla at the period of cropping; the odour is developed during the process to which the fruit is subsequently subjected. Evidence is adduced in support of the view that vanillin is formed by the action of a ferment on coniferin, the coniferyl alcohol thus produced being transformed by an oxydase into vanillin.

Oxydase was found in the best preparations of vanilla (from Mexico, Réunion, Mayotte, and Seychelles), but was absent, or nearly so, in inferior preparations from Tahiti and in "vanillon" from Guadeloupe. All the materials examined contained manganese. N. H. J. M.

**Production of Milk and Butter. Variations in the Richness of Milk in Fat.** By L. MALPEAUX and E. DOREZ (*Ann. Agron.*, 1901, 27, 449—461).—The minimum and maximum amounts of different constituents found in milk were as follows:—water, 84.5—89.6; fat, 10.4—15.5; casein, 2.9—3.8; lactose, 4.6—5.4; ash,

0.6—0.9 per cent. A low percentage of fat is not necessarily coincident with a large yield of milk. The last portion of the milk obtained in milking was found to be much richer in fat than the first portion, but contained somewhat less of the other constituents.

Soon after calving, the amount of fat is above the average, but subsequently there is a regular decrease, which, in some cases, may be considerable.

N. H. J. M.

**Poisoning by Potassium Perchlorate.** By F. R. JUNGNER (*Bied. Centr.*, 1901, 30, 711; from *Deut. landw. Presse*, 1900, No. 62).—Germination experiments were made with rye both with and without sodium nitrate (1 gram, corresponding with the amount usually applied per acre). In presence of perchlorate eight different symptoms of injury were observed, and there were also differences in composition.

N. H. J. M.

**Effect of Various Mechanical Conditions of the same Soil on Barley.** By JOHANN J. VAŇHA (*Bied. Centr.* 1901, 30, 654—657; from *Zeit. Landw. Versuchs-Wes. Oesterr.*, 1901, 4, 99).—Barley was grown in pots containing loamy clay soil, and the same soil to which varying amounts of sand and of silt respectively had been added. The same manures and the same amount of water were added to each pot.

As the fineness of the soil increased there was an increase in the yield of grain and straw; the number, length, and weight of the ears and the weight of the grain were also increased. Light sandy soil favoured the production of mealy grain, and the grain is smaller and accumulates more ash constituents than in heavy soil. The amounts of nitrogen and ash in the grain produced in the normal soil (1), and in the soil with  $\frac{3}{4}$  sand (2), and with  $\frac{1}{2}$  silt (3), were as follow:—N (1) 1.667, (2) 1.830, and (3) 1.575. Ash, (1) 2.600, (2) 2.740, and (3) 2.432 per cent.

In the original paper, fifty different properties of the single plants are discussed. Analyses of the ears and the grain are given.

N. H. J. M.

**Assimilation by Oats with different Amounts of Moisture in the Soil and with different Manures.** By L. LANGER and BERNHARD TOLLENS (*J. Landw.*, 1901, 49, 209—229).—An increase in the amount of water in the soil gave rise to increased production of grain and straw; at the same time, the percentage amount of phosphoric acid and also that of potassium (when the soil contained plenty of potassium, but not otherwise) in the produce were raised. The percentage amount of nitrogen in grain and straw diminished as the amount of soil moisture increased.

Root production diminished when the amount of water in the soil was increased, and *vice versa*.

Exclusive phosphoric acid manuring increased the total produce in soils deficient in nitrogen when the soil moisture was increased. The produce contained the greatest amount of phosphoric acid when grown on soil poor in phosphoric acid.



Excess of potassium manure in conjunction with much water promoted the growth of straw, but diminished the yield of grain.

Heinrich's results, indicating that the roots show deficiency of manures in the soil, are generally confirmed; but minimum numbers have to be modified according to the amount of water.

Langer, in opposition to Tollens, considers that the results of the analysis of oats give indications as good as, or better than, soil analysis as to the manurial constituents of the soil (compare Atterberg, *Abstr.*, 1901, ii, 573).  
N. H. J. M.

**Manurial Experiments with Beans and Barley on Heavy Marsh Soil.** By LILIENTHAL (*Biel. Centr.*, 1901, 30, 666—668; from *Fühling's Landw. Zeit.*, 1901, 80).—Field experiments with beans followed by barley on limed and unlimed plots, without manure, and with basic slag, guano, and a mixture of basic slag, sodium nitrate, and kainite respectively.

It was found that lime neutralises to a great extent the injurious effect of salts on heavy marsh land and that the amount of lime present in basic slag is not sufficient to obtain the greatest yields. When liming is adopted for rich marsh land, manures must at first be applied with caution, especially for cereals, to avoid the crop being laid.

Horse beans do not require nitrogenous manure on marsh land; fixation of nitrogen increases with the supply of phosphoric acid in the soil.

The phosphoric acid of basic slag is more effective on marsh land than that of crude guano.  
N. H. J. M.

**Sweet Potato.** By LOUIS BONNIN (*Ann. Agron.*, 1901, 27, 491—492; from *Bull. Assoc. Chim. suc. dist.*, 1901, 1028).—The following analyses are given of (1) the meal obtained by grinding the sun-dried tubers of *Ipomœa batatas*, (2) the creepers, and (3) the residues obtained after extracting the starch (13—14 per cent.) from the meal:

	Water.	Fat.	Nitrogenous. matter.	Non-nitrog. matter.	Cellulose.	Ash.
(1)	11.40	1.96	3.06	78.77	2.69	3.12
(2)	84.51	0.56	2.03	8.16	2.47	1.37
(3)	24.86	0.48	0.55	69.49	3.82	0.80

The meal and the extracted meal form suitable cattle foods when mixed with molasses, whilst the creepers are used for cows.

N. H. J. M.

**Conditions of Temperature and Moisture of a Loamy Soil with different Crops and different Manures.** By CONRAD VON SEELHORST (*J. Landw.*, 1901, 49, 231—250).—The result of pot experiments showed that the unmanured soil gave up the most water and the soils which received potassium manure and sodium nitrate, or a mixture of both, the least water. Superphosphate had not much effect. The pot with potassium manure and superphosphate lost



water more quickly than the superphosphate pot, whilst potassium carbonate alone strongly retained water.

In subsequent experiments with sand, it was again found that the evaporation was greatest without manure or with superphosphate. Calcium carbonate had practically no effect.

A large number of moisture determinations were made in soils growing different crops and with different manures. The soil of plots which received no nitrogen always contained the greatest amounts of water owing to the increased evaporation from the crop. The difference in the amount of moisture exists long after the removal of the crop.

Manuring has only an indirect influence on the temperature of the soil, due to the greater amount of shade by denser crops. The differences, however, do not seem to be of practical importance.

N. H. J. M.

**Relative Manurial Value of Ammonium Salts [and Sodium Nitrate].** By PAUL WAGNER (*Bied. Centr.*, 1901, 30, 668—670; from *Mitt. deut. landw. Ges.*, 1901, Nos. 10 and 11).—The results of field experiments in 1899 and 1900 in which rye, oats, barley, sugar beet, mangels, and potatoes were manured with sodium nitrate and ammonium salts respectively, showed the relative value of the two forms of nitrogen to be as 101 : 67 for grain and as 100 : 65 for straw, in the case of the three cereals taken together. The season was, however, in both years, unfavourable for the utilisation of ammonium salts.

In the case of roots, the value of the ammoniacal nitrogen was only 48 as compared with nitric nitrogen = 100. This is, perhaps, to be partly attributed to the action of the sodium of the nitrate.

None of the soils on which the experiments were made were, physically, exceptionally unfavourable for ammonium salts; but it is possible that some, even those richer in calcium, contained too little calcium carbonate for the rapid conversion of ammonia into nitrate.

N. H. J. N.

**Manurial Experiments with Sodium Nitrate in the Redwine District of Ahrthal.** By PAUL KULISCH (*Bied. Centr.*, 1901, 30, 670—671; from *Ber. k. Lehranstalt Obst-, Wein-, u. Gartenbau, Geisenheim a. Rhein*, 1900, 103).—The application of sodium nitrate (300 kilos. per hectare) had a very striking effect on the stony, hilly land; more stem and leaf were produced, whilst the development of the grapes was improved. In the case of humous loam, nitrate had very little effect.

Sodium nitrate had no injurious effect on the must. Any differences which were observed were in favour of the manured plots.

N. H. J. M.

**Employment of Ammoniacal Manures on Calcareous Soils.** By ERCOLE GIUSTINIANI (*Ann. Agron.*, 1901, 27, 462—486. Compare *Abstr.*, 1899, ii, 692).—Ammonium manures may be used with advantage on damp, and generally on stony, soils containing calcium

carbonate. In rich soils, nitrification is slow, and the effect of ammonium salts is less rapid, but more durable, than that of sodium nitrate. Ammonium salts should not be applied to sandy soils which contain no calcium carbonate, or to sandy, calcareous soils. A light soil, with 5—20 per cent. of calcium carbonate, may, if not too dry, benefit by application of ammoniacal manures; the manure might, with advantage, be added by degrees.

When basic slag and ammonium sulphate are employed for the same soil, the former should be applied some days in advance in order to convert the free lime into carbonate.

N. H. J. M.

**Solubility of Phosphatic Manures in some Organic Acids.** By WALTER F. SUTHERST (*Chem. News*, 1901, 84, 199—200).—A gram of the phosphate and a gram of citric acid, or a quantity of acetic or tartaric acid to give the same total acidity, were made up to 100 c.c. with water, left in contact for 24 hours with frequent agitation, then filtered, and the phosphoric acid estimated in the solution with the following results per cent., calculated as tricalcium phosphate.

	Acetic acid.	Tartaric acid.	Citric acid.
Coprolite.....	10·13	32·60	17·17
Basic slag .....	12·30	15·85	19·67
Basic superphosphate.....	18·53	28·37	24·79
Precipitated phosphate ...	43·72	78·12	71·27

The phosphates contained respectively 84·29, 29·13, 28·38, and 80·73 per cent. of phosphoric acid calculated as tricalcium phosphate.

D. A. L.

**Manurial Experiments.** By JOHN SEBELIEN (*Bied. Centr.*, 1901, 30, 671—681; from *Norsk. Landm.-bl.*, 1901, Nos. 12, 13, and 14).—Excessive amounts of artificial manures (more than 10,000 kilos. of kainite per hectare) proved to be very injurious to peas, whilst more than 5000 kilos. of potassium sulphate were beneficial. In the case of carrots, the large amount of kainite was not injurious, but slightly increased the yield (5·9 per cent.), whilst potassium phosphate increased the yield by 32 per cent. The injurious effect of the kainite on peas lasted over the second year when the kainite was applied alone; in the case of the plot which received an excessive amount of superphosphate in addition to the kainite, there was no injury the second year.

The results of pot experiments in which ammonium sulphate and sodium nitrate were compared showed no marked difference, except in absence of potassium, in which case the nitrate gave the greatest yield of barley straw and grain.

Similar experiments with potassium chloride and sulphate showed that the chloride raised the yield of grain, whilst the sulphate increased the yield of straw.

N. H. J. M.

**[Manurial] Action of various Calcium and Magnesium Compounds.** By DIEDRICH MEYER (*Chem. Centr.*, 1901, ii, 825; from *Landw. Jahrb.*, 30, 619—631).—In pot experiments, it was found

that with a mixture of *Lolium perenne* and lucerne and oats, addition of more than 1 gram of calcium oxide in the form of gypsum considerably diminished the yield. Potatoes were not affected by gypsum. Addition of calcium or magnesium carbonate prevented any injurious action by gypsum; addition of soil to the sand also reduced the injurious effect to a minimum, so that there can be no objection, in practice, to the relatively small amounts of gypsum which are employed.

Small amounts of magnesium carbonate increased the yield of *Lolium* and lucerne, whilst large amounts were injurious; horse beans and vetches were not injured by large quantities. Calcium carbonate may be almost completely replaced by magnesium carbonate, but a mixture of the two gives the best results, even when an excess of lime is present. Dolomite marl is therefore at least as suitable as pure lime marl.

N. H. J. M.

**Drainage Water.** By CREYDT, CONRAD VON SEELHORST, and WILMS (*J. Landw.*, 1901, 49, 251—275).—The field from which the drainage was collected had an area of 4.81 hectares. The cropping had been as follows: 1897, roots; 1898, wheat; 1899, beans, and 1900, roots. The manures applied were ammonium sulphate, sodium nitrate, and superphosphate. The daily amounts of rainfall and the estimated amounts of drainage from July, 1899, to August, 1900, are given in tables. Analyses were made in a large number of mixed samples of the drainage.

It was found that in winter there was more drainage than rain, and the constituents of the winter drainage were therefore not derived from the surface of the field alone.

The maximum and minimum amounts of the different substances found in the drainage were as follows:  $K_2O$ , 1.75—3.69;  $CaO$ , 157.0—184.0;  $MgO$ , 31.3—46.4;  $SO_3$ , 43.5—59.2; and  $N_2O_5$ , 1.0—8.2 per million. Increased temperature seemed to increase the amount of lime, owing to greater production of carbon dioxide. Traces of phosphoric acid were always present in the drainage.

The estimated losses per hectare are as follows:  $K_2O$ , 8.4;  $CaO$ , 630;  $MgO$ , 140;  $SO_3$ , 182; and N, 4.4 kilos. The loss of potassium is very slight, whilst that of phosphoric acid is still less.

N. H. J. M.

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## Analytical Chemistry.

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**Microchemical Test for Alkalis and Acids; Detection of small Quantities of Ozone and Water.** By FRIEDRICH EMICH (*Monatsh.*, 1901, 22, 670—678).—As a microchemical test for alkalis and acids, the author uses silk dyed either with red or blue litmus. A drop (0.05 mg.) of the liquid the reaction of which is to be tested is placed on a glass slide and observed under a microscope magnifying

200 times, a condenser being used. Into this drop, a silk thread coloured with litmus is introduced. It is found that a perceptible colour change is given by the following quantities of alkalis, stated as millionths of a milligram; 0.3 of sodium or potassium hydroxide, lithium, or caesium carbonate; 0.5 of sodium, potassium, or rubidium carbonate; 30 of barium hydroxide and 10 of calcium hydroxide; and of acids 0.5 of sulphuric, hydrochloric, or nitric acid; 1 of oxalic and 3 of acetic acid. Solutions of lithium, potassium, or rubidium carbonate, which have no effect on the colour of the flame, will yet give a marked reaction with the above reagent.

Silk coloured with litmus can also be used for the detection of ozone, in the presence of potassium iodide or potassium ferrocyanide when red litmus is used, or of sulphur or potassium thiocyanate with blue litmus.

K. J. P. O.

**Methods of Standardising Acid Solutions.** By CYRIL G. HOPKINS (*J. Amer. Chem. Soc.*, 1901, 23, 727—740).—The author has studied the respective merits of the following methods for standardising volumetric acids: the silver chloride method, conversion into ammonium sulphate, use of metallic sodium, use of pure crystallised borax, electrolysis of copper sulphate, and standardising oxalic acid by means of metallic iron and potassium permanganate. Of these, the first two methods gave the best results.

In the silver chloride method, a carefully measured quantity of approximately correct hydrochloric acid is precipitated with silver nitrate and the resulting silver chloride is collected in a Gooch crucible, washed, dried at 130—150°, and weighed. The ammonium sulphate method consists in neutralising a definite volume of approximately correct sulphuric acid with ammonia and drying the residue at 120° (compare Weinig, *Abstr.*, 1893, ii, 245).

L. DE K.

**Normal Alkalis and Indicators in Acidimetry.** By C. A. JUNGCLAUSSEN (*Chem. Centr.*, 1901, ii, 896—897; from *Apoth. Zeit.*, 16, 664—666).—Normal potassium hydroxide may be conveniently made from fresh ordinary "caustic potash purified by alcohol." The solution should then be standardised with normal hydrochloric or oxalic acid, phenolphthalein being used as indicator. Although the solution may not be free from carbon dioxide, this does not matter in the least whether titrating from acidity to alkalinity or the reverse way, provided the liquid is cold and that phenolphthalein is employed.

A deci- or centi-normal solution may be prepared from the above normal solution and used for the titration from acid to alkaline reaction only, using iodeosin as indicator; the solutions should, however, be checked with *N*/10 or *N*/100 hydrochloric acid and the necessary correction applied.

In cases where hæmatoxylin is used as indicator, the alkali should be completely freed from carbon dioxide by cautious addition of barium hydroxide.

L. DE K.

**Estimation of Chlorine in Natural Waters.** By LUDWIG W. WINKLER (*Zeit. anal. Chem.*, 1901, 40, 596—600).—In titrating chlorides by Mohr's method, the results are seriously too high when



the chlorine present is less than 25 mg. per litre, because a certain amount of silver nitrate is needed to produce a visible precipitate of silver chromate. Using a silver nitrate solution, of which 1 c.c. equals 0.001 gram of chlorine, the amount to be subtracted, when working in the manner here prescribed, is shown in the following table :

Solution used, c.c.....	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	2.0
Correction, c.c. ....	0.2	0.25	0.3	0.33	0.36	0.38	0.39	0.40	0.41	0.44

From 2 c.c. up to 10 c.c., the correction increases regularly by 0.02 c.c. for each additional c.c. of solution used.

In each of two bottles of 150 c.c. capacity, there is placed 1 c.c. of a 1 per cent. solution of potassium chromate. To the first bottle is added about 90 c.c. of the water to be titrated and just enough silver solution to produce a red colour, which is then removed by another 10 c.c. of the water. This mixture then serves as a standard for comparison. To the second bottle, 100 c.c. of the water are added and then silver nitrate until a just visible red colour persists for 5—10 minutes. The bottles must be protected from light as much as possible. The results of some titrations of very weak chloride solutions show that even when the correction is three times the amount to be estimated, very close agreement with gravimetric determinations can be obtained.

M. J. S.

**Estimation of Sulphur and Phosphorus in Iron and Steel.**  
By UBALDO ANTONY (*Gazzetta*, 1901, 31, ii, 274—277).—To rapidly determine sulphur and phosphorus in iron, the author recommends the use of an oxidising mixture consisting of 4 parts of manganese dioxide, 1 of potassium permanganate, and 2 of dry sodium carbonate, the procedure being as follows : 5 grams of the finely powdered sample are well mixed in a platinum crucible with 40 grams of this oxidising mixture, a layer of the latter being also laid on the surface and the whole heated gradually at first, afterwards more strongly, and finally to a bright red heat by means of a blowpipe flame, the mass being meanwhile kept well stirred with a platinum wire. When cool, it is extracted with boiling water, the filtrate acidified with nitric acid and evaporated to a volume of about 30 c.c., to which is added a little ferric chloride, then ammonium chloride and ammonia, the liquid being then heated and filtered ; by this means, silica, phosphates, and arsenates are removed. The filtrate is used for the estimation of the sulphur as barium sulphate, whilst the precipitate is dissolved in hydrochloric acid, the solution evaporated to dryness, and the residue maintained for some time at 120—130°, to insure the insolubility of the silica. The mass is then dissolved in dilute hydrochloric acid and any arsenic removed by means of hydrogen sulphide, the excess of which is then boiled off. Ammonium molybdate is then added to precipitate the phosphoric acid, which is afterwards reprecipitated as ammonium magnesium phosphate and weighed as magnesium pyrophosphate. Other elements, such as tungsten, chromium, &c., often present in steel, can also be detected and determined by this method.

T. H. P.



**New Nitrometer for use with the Sprengel Pump.** By GIUSEPPE ODDO (*Gazzetta*, 1901, 31, ii, 215—217).—This nitrometer, which is especially adapted for collecting and measuring nitrogen in its estimation in organic compounds, is a modification of Schiff's and is fitted near the bottom with three apertures, one for running off the mercury, the second for connecting with the Sprengel pump, and the last, which is slightly above the other two, for the entry of the potash solution. A sketch of the apparatus is given. T. H. P.

**Action of Ammonium Carbonate on the Arsenic Sulphides** By LUDWIG VANINO and C. GRIEBEL (*Zeit. anal. Chem.*, 1901, 40, 589—591).—Solutions of arsenious or arsenic sulphide in ammonium carbonate should, when acidified, yield in the form of sulphide the whole of the arsenic they contain, without the necessity for adding hydrogen sulphide. Practically, however, some hydrogen sulphide is always given off on adding acid, and the precipitation is consequently incomplete. If, however, the solution is largely diluted and acidified in a bottle, which is then closed for 24 hours, the hydrogen sulphide is re-absorbed and every trace of arsenic is precipitated. If an open vessel is used, or a concentrated solution is acidified, addition of hydrogen sulphide is indispensable.

In separating the arsenic sulphides from those of tin and antimony by concentrated hydrochloric acid, boiling must be avoided, or a loss of arsenic by volatilisation will occur. M. J. S.

**Gravimetric Estimation of Boric Acid.** By ALFRED PARTHEIL and J. A. ROSE (*Ber.*, 1901, 34, 3611—3612).—The distribution ratio obtained by shaking  $N/10$  boric acid solution with ether at  $26^{\circ}$  is  $34.2 : 1$ . The boric acid solution, acidified with hydrochloric acid, is extracted with ether for some 18 hours in a specially constructed extractor or 'perforator,' in which the ether is made to work its way continually through the aqueous solution contained in a spiral tube. The flask containing the ethereal solution is afterwards placed in a vacuum desiccator over sulphuric acid and the residue weighed. The ether must not be distilled off at the atmospheric pressure, as boric acid volatilises with ether vapour. The method gives good results and may be employed for estimating the acid in various minerals. Sulphuric, phosphoric, and nitric acids, or appreciable amounts of iron, must not be present. J. J. S.

**Separation and Estimation of small amounts of Potassium in Saline Mixtures.** By FREDERIK H. VAN LEENT (*Zeit. anal. Chem.*, 1901, 40, 569—573).—From solutions containing small amounts of potassium with large quantities of sodium chloride, magnesium and calcium salts, the potassium is best separated as potassium cobaltinitrite, after which it may be weighed as perchlorate or platinichloride. The calcium and most of the magnesium should be removed by sodium carbonate. The filtrate is then slightly acidified with acetic acid and treated with the cobalt reagent, which is prepared by mixing, just before use, equal volumes of sodium nitrite solution (180 grams per litre) and cobalt solution containing 19.16 grams of crystallised cobalt

chloride, and 50 c.c. of glacial acetic acid in a litre. The precipitate is allowed to subside for 6—7 hours at 40—50°, and then all night in the cold, and after collecting on a filter is washed once with the reagent and then thoroughly with 80 per cent. alcohol. The dried precipitate is decomposed by evaporating with hydrochloric acid; perchloric acid is then added, and the mixture evaporated until white fumes are given off. The potassium perchlorate is triturated and washed with 96 per cent. alcohol, to which 0.2 per cent. of perchloric acid has been added, and then on the filter with ether-alcohol. It is dried on the filter at 120—130° and weighed. For weighing as platinichloride, the yellow precipitate should be decomposed by gentle ignition, the potassium nitrite dissolved out by a weak sodium chloride solution (to prevent the cobalt oxide from passing through the filter), and evaporated with hydrochloric acid to convert it into potassium chloride. M. J. S.

**Estimation of Hydroxide in the Presence of Alkali Carbonate.** By W. E. RIDENOUR (*Chem. News*, 1901, 84, 202).—The author has tested the process of titration of alkali hydroxide in the presence of carbonate, using first phenolphthalein and then methyl-orange; he finds that phenolphthalein does not indicate half the carbonate, either alone or in presence of the hydroxide. To ascertain the number of c.c. of normal acid corresponding with the carbonate in a mixture of alkali hydroxide and carbonate he multiplies by 2 the number of c.c. of normal acid indicated by methyl-orange, using phenolphthalein, then methyl-orange, and divides by 104.5726. D. A. L.

**Estimation of Cadmium.** By EDMUND H. MILLER and ROBERT W. PAGE (*Zeit. anorg. Chem.*, 1901, 28, 233—241).—The electrolytic method of estimating cadmium is convenient and gives trustworthy results if care is taken to avoid a large excess of potassium cyanide and the presence of other salts. A current of 0.1 to 0.15 ampere is employed and the estimation takes about 16 hours.

The estimation by precipitation with sodium carbonate gives very unsatisfactory results.

A convenient and accurate method is to precipitate the cold neutral cadmium solution with an excess of diammonium phosphate. The precipitate must be allowed to remain for some time and is then transferred to a weighed filter and dried at 105°, or is converted into pyrophosphate and then weighed. The solution must not be heated, since the precipitate of ammonium cadmium phosphate gives off ammonia on boiling and is partially converted into cadmium orthophosphate. E. C. R.

**Estimation of Mercury in Antiseptic Solutions containing Mercuric Chloride, Iodide, or Cyanide.** By G. MEILLÈRE (*J. Pharm. Chim.*, 1901, [vi], 14, 356—359).—Attention is drawn to the fact that mercurial antiseptic solutions contain, as a rule, other substances besides the mercury salt, so that mere evaporation of the solution and weighing the residue gives erroneous results. With solutions containing mercuric chloride or iodide, accurate results may be obtained by extracting them with ethyl acetate and weighing the residue

left on evaporation of the ethereal solution. Mercuric cyanide may be estimated by means of a standard solution of iodine in the presence of an excess of an alkali hydrogen carbonate. It is necessary to add an excess of the iodine solution, which excess may be estimated by means of a standard solution of sodium thiosulphate. H. R. LE S.

**Gravimetric and Volumetric Estimation of Mercury, Copper, and Zinc.** By ROBERT COHN (*Ber.*, 1901, 34, 3502—3508).—*Volumetric estimation of mercury.*—An excess of  $N/10$  ammonium thiocyanate is added to the solution of mercury and the excess determined after the addition of nitric acid and ferric alum by means of  $N/10$  silver nitrate; it is best in the titration to add more silver nitrate than is necessary for decolorisation, and to titrate back with the thiocyanate as in Volhard's method. The method depends on the formation of sparingly soluble, non-dissociating mercury thiocyanate,  $\text{Hg}(\text{CNS})_2$ .

*Volumetric estimation of copper and zinc.*—A solution of mercuric chloride (0.1 mol.) and ammonium thiocyanate (0.4 mol.) in water (1 litre) is standardised by means of  $N/10$  silver nitrate according to Volhard's method; on adding to an excess of this a known volume of the copper or zinc solution, a precipitate of the type  $\text{M}''\text{Hg}(\text{SCN})_4$  is formed, and, after filtering, an aliquot portion of the liquid is titrated against the silver nitrate solution. From the difference in the values for the titration of the same quantity of mercuric thiocyanate solution before and after precipitation, the amount of copper or zinc follows from the relationship  $\text{Cu}(\text{or Zn}) : \text{SCN} = 1 : 2$ . The equations involved are, for example, (1)  $\text{HgCl}_2 + 4\text{NH}_4\text{SCN} + 4\text{AgNO}_3 = \text{Hg}(\text{SCN})_2 + 2\text{AgSCN} + 2\text{AgCl} + 4\text{NH}_4\text{NO}_3$ ; (2)  $\text{HgCl}_2 + 4\text{NH}_4\text{SCN} + \text{CuSO}_4 + 2\text{AgNO}_3 = \text{Hg}(\text{SCN})_2 + \text{Cu}(\text{SCN})_2 + 2\text{AgCl} + \text{K}_2\text{SO}_4 + 2\text{NH}_4\text{NO}_3$ .

*Gravimetric estimation of the three metals.*—In the case of copper and of zinc, the precipitate of the type  $\text{M}''\text{Hg}(\text{SCN})_4$  is left for two hours in the cold, filtered, and ignited; with copper, the filter paper and precipitate are burned together, and when a large quantity has to be weighed, the product is converted into cuprous sulphide by reduction in a stream of hydrogen and the addition of sulphur. With smaller amounts, the product is ignited with pure mercuric oxide, and weighed as copper oxide. In the case of zinc, the procedure is similar, but the filter paper has to be initially removed. To estimate mercury, it is precipitated by a solution of zinc sulphate (1 mol.) and alkali thiocyanate (4 mols.), and the zinc oxide, ultimately obtained, weighed. W. A. D.

**Volumetric Estimation of Manganese.** By HUGH RAMAGE (*Chem. News.* 1901, 84, 209—210).—To correct for various incidental reactions, the method for titrating manganese described by the author and Reddrop (*Trans.*, 1895, 47, 268) has been modified so far as wrought iron, steel, and pig-iron are concerned:—1.1 gram of the sample is dissolved by boiling with 30 c.c. of dilute nitric acid, the solution is cooled, then boiled for 3 minutes with 0.5 gram, or more, of sodium bismuthate, cooled again, treated with a slight excess of sulphurous acid, reoxidised with 1.5 gram of sodium bismuthate, and filtered. Hydrogen peroxide is run in at first until the reddish colour gives

place to a clear yellow solution, then 0.6 to 1.0 in excess is added. The solution is titrated with *N*/10 permanganate. D. A. L.

**Detection of Chromic Acid by Hydrogen Peroxide in presence of Vanadic Acid.** By C. REICHARD (*Zeit. anal. Chem.*, 1901, 40, 577—586).—The blue colour attributed to perchromic acid, produced by the action of hydrogen peroxide on chromic acid, is destroyed or prevented by the addition of vanadic acid with production of a brown colour. The blue ethereal solution of perchromic acid is decolorised by ammonium metavanadate. Addition of sodium phosphate or arsenate annuls the action of vanadic acid; a nitrate has no such effect. Molybdates and tungstates also destroy perchromic acid, but not so energetically as vanadates. M. J. S.

**Estimation of Uranium.** By EDWARD F. KERN (*J. Amer. Chem. Soc.*, 1901, 23, 685—726).—Uranium solutions may be freed from the metals of the fifth or sixth group by a current of hydrogen sulphide providing 50 parts of the liquid contain no more than 1 part of free hydrochloric or nitric acid. From metals of the third or fourth group, it may be isolated by boiling for 15 minutes with a large excess of sodium carbonate. Ferric iron may be completely separated from uranium by shaking the hydrochloric acid solution three times in succession with pure ether; it is, however, essential that the acid should have a sp. gr. of 1.1 and that the ether be previously saturated with the acid. From an acetic acid solution containing alkalis or alkaline earths, uranium may be precipitated as hydrated oxide,  $U_3O_8 \cdot 3H_2O$ , by electrolysis, or it may be separated by a thrice repeated precipitation in a hot solution with ammonia in the presence of ammonium chloride; the ammonium uranate, at first slimy and yellow, becomes darker and crystalline after 20 minutes' boiling and is readily converted into  $U_3O_8$  by ignition over the blast with free access of air. Uranium may be also separated from alkalis by precipitating the boiling liquid with ammonium phosphate in the presence of ammonium acetate. After boiling for 15 minutes, the precipitate becomes crystalline, and, like the ammonium uranate, it is washed with a 2.5 per cent. solution of ammonium chloride and then ignited in a porcelain crucible. It is then moistened with nitric acid, reignited, and weighed as uranyl pyrophosphate. Several methods are given for the separation of uranium from phosphoric acid, the most convenient process being the treatment of the nitric acid solution with metallic tin at the boiling temperature. The most rapid estimation of uranium is accomplished by reducing the sulphuric acid solution with metallic zinc and titrating the resulting uranous sulphate with standard permanganate in an atmosphere of carbon dioxide. Full particulars will be found in the original paper. Reduction of a hydrochloric acid solution either by zinc or stannous chloride gives unsatisfactory results.

The assay of uraninite (pitchblende) is best made by the ether method, which is briefly as follows: The mineral is dissolved in nitric acid and repeatedly evaporated with addition of hydrochloric acid. After removing lead, copper, &c., by hydrogen sulphide, the filtrate is



boiled and oxidised with nitric acid and precipitated whilst boiling with ammonia. The precipitate which also contains ammonium uranate, is, after washing, dissolved in hydrochloric acid and agitated with ether to remove the ferric chloride. The aqueous acid solution is nearly neutralised with ammonia and then boiled with a large excess of ammonium carbonate. The filtrate which contains the uranium is then boiled down to a small bulk, the precipitate redissolved by addition of hydrochloric acid, and the solution again boiled to expel carbon dioxide. The uranium is then precipitated as directed by ammonia, or by ammonium phosphate, or estimated volumetrically after expelling the chlorine by means of sulphuric acid, or precipitated by electrolysis.

Some ores of uranium such as carnotite contain vanadium. This may be got rid of by simply evaporating the nitric acid solution to dryness, and dissolving the residue in a hot solution of ammonium nitrate which dissolves the uranium and leaves the vanadium undissolved; no phosphates should be present. It may also be removed by excess of sodium hydroxide or by neutralising the nitric acid solution with mercuric oxide and then adding mercurous nitrate.

L. DE K.

**Detection and Estimation of Traces of Antimony in presence of large quantities of Arsenic.** By GEORGES DENIGÈS (*Compt. rend.*, 1901, 133, 688—689).—If tin is used instead of zinc in contact with platinum for the detection of antimony by deposition on the platinum in the form of a dark stain, the reaction becomes much more delicate and will detect 0.002 mg. of antimony in 0.05 c.c. of hydrochloric acid (1 : 4) provided that the quantity of arsenic present does not exceed 5 mg. per c.c. The rapidity with which the stain appears is a function of the quantity of antimony present and for a given time the depth of the stain is also a function of that quantity. The reaction can be used quantitatively by making precisely similar tests with solutions containing known quantities of antimony.

A still more sensitive reaction is obtained with antimony caesium iodide. The antimony compound is dissolved in dilute hydrochloric acid (1 : 4) or dilute sulphuric acid (1 : 10), and the reagent is made by dissolving 1 gram of potassium iodide and 3 grams of caesium chloride in 10 c.c. of water. A drop of the antimony solution and one of the reagent are mixed and examined under the microscope, when the antimony caesium iodide is seen to form in yellow or garnet-red hexagonal lamellæ, often grouped in stellate macles. The reaction will detect 0.0001 mg. of antimony in presence of 500 times the quantity of arsenic. It is important that the quantity of arsenic does not exceed 50 mg. per c.c., as with a larger quantity iodine will probably be liberated. Quantitative results can be obtained by the method of comparison.

C. H. B.

**Analysis of White Metal Alloys.** By FRED IBBOTSON and HARRY BREARLEY (*Chem. News*, 1901, 84, 167—169).—Antimony as precipitated reduces solutions of stannic chloride in the cold very slowly, whereas pulverised smelted antimony is inactive. The authors therefore



employ the latter at the boiling point in place of iron for the estimation of tin. With finely powdered metal, the reduction takes place rapidly, and when complete the solution is allowed to cool in an atmosphere of carbon dioxide and titrated with iodine. One-fifth the volume of strong hydrochloric acid is usually employed, but in the presence of copper one-third the volume is used, and in the presence of lead there must be plenty of acid to prevent the formation of cuprous iodide in the one case, or lead iodide in the other. Iron, chromium, nickel, zinc, manganese, aluminium, bismuth, tungsten, phosphorus, sulphur, mercury, molybdenum, and cobalt are inactive or exert a negligible influence in the cold. Arsenic, however, is precipitated and carries some tin with it; and in the case of antimony, when iron is used for the reduction, the tin is all reduced before the appearance of the antimony, a result which serves as an indication that all the stannic chloride is reduced.

D. A. L.

**Estimation of Chloroform.** By WILLIAM A. PUCKNER (*Pharm. Arch.*, 1901, 4, 124—128).—The following process is recommended as being particularly suitable for the estimation of chloroform in a mixture of chloroform and ether. A quantity of the mixture equal to 0.05—0.2 gram of chloroform is put into a strong flask containing 10 c.c. of *N* alcoholic potassium hydroxide free from chlorine, the flask is closed with a sound cork, covered with cloth and tied down firmly. After gently mixing the liquids, the flask is put in boiling water for 3 hours. When cold, the contents are carefully neutralised with *N* sulphuric acid, using phenolphthalein as indicator, and the chlorine is then estimated by means of silver nitrate and potassium chromate. Or the cold liquid may be acidified with nitric acid and titrated by Volhard's thiocyanate process. From the amount of chlorine thus found, the percentage of chloroform in the mixture is readily calculated.

If the percentage of chloroform in the sample is quite unknown, it may be determined approximately by digesting 1 c.c. for an hour with 25 c.c. of *N* alcoholic potassium hydroxide and titrating the excess of alkali. One c.c. of *N* alkali consumed  $\times 0.02977$  equals the amount of chloroform per c.c.

L. DE K.

**Estimation of Cyanide in the presence of a Chloride.** By FRANK B. GATEHOUSE (*Chem. News*, 1901, 84, 197).—When silver nitrate is added to a solution of potassium cyanide, the soluble double cyanide,  $\text{KCN}, \text{AgCN}$ , is first formed, and no precipitate is obtained so long as there is cyanide in solution. Therefore, titration with *N*/10 silver nitrate until a permanent turbidity appears may be used to estimate the cyanide; each c.c. used = 0.013036 gram of potassium cyanide. An equal volume of the *N*/10 solution is then added, the burette read, potassium chromate introduced as indicator, and the chloride estimated in the usual way.

D. A. L.

**Estimation of Alcohol in Ether.** By FRANZ FREYER (*Chem. Centr.*, 1901, ii, 900; from *Zeit. landw. Versuchs-Wes. Oesterr.*, 4, 955—959).—The amount of alcohol and water is estimated by agitat-

ing 20 c.c. of the sample with a saturated solution of calcium chloride and noticing the diminution in volume. Twenty-five c.c. of the sample (which should not contain more than 1 gram of alcohol and water, otherwise it should be diluted with anhydrous ether) are put into an Erlenmeyer flask, mixed with 50 c.c. of a 10 per cent. solution of acetyl chloride in chloroform and the flask closed with an india-rubber cork, through which passes a separating funnel containing 100 c.c. of water. After the lapse of an hour, a little of the water is introduced, and the whole well shaken and then titrated with 2 *N* alkali, phenolphthalein being used as indicator. A blank experiment is then made with 50 c.c. of the acetyl chloride solution, mixed with anhydrous ether, which is titrated in the same manner. The difference in the two titrations represents the alcohol, inasmuch as by the action of alcohol on acetyl chloride only 1 mol. of free acid is formed, whilst water liberates 2 mols. One c.c. of 2 *N* alkali = 0.092 gram or 0.1157 c.c. of alcohol.

L. DE K.

**Quantitative Esterification and Estimation of Alcohols and Phenols.** By ALBERT VERLEY and FR. BÖLSING (*Ber.*, 1901, 34, 3354—3358).—Esterification takes place rapidly and completely when a mixture of acetic anhydride and pyridine is used in place of acetic anhydride. For quantitative esterification, a mixture of 120 grams of acetic anhydride and 880 grams of pyridine is used; this is titrated with standard alkali, and again after heating with a known weight of the alcohol or phenol. The method has been successfully used with ethyl alcohol, amyl alcohol, cinnamic alcohol, menthol, phenylglycol, glycerol, phenol,  $\beta$ -naphthol, guaiacol, saligenin, thymol, eugenol, carvacrol, and santalol, but geraniol, terpineol, vanillin, benzyl alcohol, and linalool could not be satisfactorily determined by this method.

T. M. L.

**Estimation of Eugenol in Oil of Cloves.** By ALBERT VERLEY and FR. BÖLSING (*Ber.*, 1901, 34, 3359—3362).—Eugenol can be satisfactorily estimated in oil of cloves by quantitative esterification with a mixture of acetic acid and pyridine, provided that other phenols and alcohols are absent. Umney's method (*Pharm. J.*, 1895, 25, [iii], 950), in which the oil is extracted with 10 per cent. alkali and the residue weighed, is liable to large errors; Thoms' method (*Abstr.*, 1892, 250) gives small values with oils rich in terpenes.

T. M. L.

**Nickel Salts as Reagents for Reducing Sugars.** By MAURICE DUYK (*Ann. Chim. anal. appl.*, 1901, 6, 364).—The reagent is best prepared by adding to 25 c.c. of a 20 per cent. solution of nickel sulphate 20 c.c. of aqueous sodium hydroxide of sp. gr. 1.33 and 3 grams of tartaric acid dissolved in 50 c.c. of water. A clear, slightly green liquid is thus obtained which does not change on boiling, but is at once reduced on adding a reducing sugar, with separation of a lower oxide having a brown, or even intense black, colour. The reagent is likely to be of great service in urine analysis, as it is not in the least affected by normal urine. Sollmann (*Abstr.*, 1901, ii, 535) has also applied nickel salts, but his conclusions differ somewhat from those of the author.

L. DE K.

**Detection of Sucrose in Plants by means of Invertin, and of Glucosides by means of Emulsin.** By EMILE BOURQUELOT (*Compt. rend.*, 1901, 133, 690—692).—The presence of sucrose in vegetable extracts is most conveniently detected, and its quantity estimated, by the action of invertase, the rotatory power of the liquid being determined before and after the action of the ferment. Invertase also hydrolyses gentianose, and raffinose, but these substances are comparatively rare, and the products of hydrolysis are readily distinguished from those of sucrose. Emulsin may be employed with advantage in the same manner for the detection and estimation of glucosides. For example, the pericarp of *Cocos Yatai* and the seed of asparagus were found to contain a considerable proportion of sucrose but no glucosides, whilst the rhizome of *Scrophularia nodosa* contained a considerable quantity of a laevorotatory glucoside. C. H. B.

**Estimation of Starch in the Grain of Cereals.** By LÉON LINDET (*J. Pharm. Chim.*, 1901, [vi], 14, 397—400. Compare Abstr., 1897, ii, 525).—The process only differs from the one previously described in that, instead of collecting the starch on a tared filter, the amylaceous liquid is siphoned off, and the starch which is left behind is washed by decantation, and then hydrolysed with dilute sulphuric acid. The resulting glucose and dextrin are then estimated by means of Fehling's solution and the polarimeter. H. R. LE S.

**Estimation of Formaldehyde.** By LUDWIG VANINO and E. SEITTER (*Zeit. anal. Chem.*, 1901, 40, 587—589).—An excess of potassium permanganate strongly acidified with sulphuric acid oxidises formaldehyde quantitatively to carbon dioxide and water. The proportions recommended are 30 grams of concentrated sulphuric acid, 50 c.c. of water (mixed and cooled), 35 c.c. of *N*/5 permanganate, and 5 c.c. of a 1 per cent. solution of formalin. After 10 minutes, the excess of permanganate is titrated by an empirical solution of hydrogen peroxide. The results agree well with those obtained by Romijn's method, which is adopted by the Verein für Chemische Industrie in Mainz (Abstr., 1900, ii, 326). M. J. S.

**Some sources of Error in the Estimation of the Volatile Acidity of Wines.** By CURTEL (*Ann. Chim. anal. appl.*, 1901, 6, 361—364).—The author states that the total acidity of a wine as found by direct experiment is always less than the sum of acids existing in it, and has investigated the cause of this phenomenon.

The volatile acids will be found too high if the wine should contain neutral acetates or similar salts, as, on boiling, part of the acid is liberated by the action of potassium hydrogen tartrate, or even tannic acid. Several experiments are given showing that the volatile acids thus formed may be equivalent to as much as 0.06 per cent. of acetic acid. Another serious source of error is the introduction of carbon dioxide by means of the steam which is passed through the wine when estimating the volatile acids. The steam should be generated from recently boiled distilled water. The error may amount to 0.029 per cent. expressed as acetic acid. A third, although less important, source

of error is the presence of ethyl acetate, which, when boiled with water, yields a faintly acid distillate, which may account for 0.009 per cent. of volatile acid.

In order to avoid these errors, the author first estimates the total acidity, less carbon dioxide. Twenty-five c.c. of the wine and 25 c.c. of water are introduced into a small flask furnished with a doubly perforated cork and placed on a heated sand-bath, and steam is passed through at such a rate that the liquid does not undergo any sensible alteration in volume. After the lapse of an hour, the acidity is again determined, the difference between the two experiments being the volatile acidity.

L. DE K.

**Supposed Use of Oxalic Acid for the Preparation of Hydrogen Peroxide.** By AUGUSTE NICOLLE (*Chem. Centr.*, 1901, ii, 834—835; from *Mon. scient.*, [iv], 15, ii, 576. Compare Abstr., 1901, ii, 622).—The following process is proposed for the detection of oxalic acid in commercial hydrogen peroxide. Five hundred c.c. of the sample are evaporated to dryness on the water-bath with addition of pure sodium hydroxide, the well-dried residue is dissolved in dilute nitric acid, about 50 c.c. of water are added, together with calcium nitrate or chloride, and then excess of ammonia. The liquid is heated, the precipitate washed free from soluble salts by decantation, and then heated at 50° with 30 c.c. of sulphuric acid of sp. gr. 1.2—1.4. The filtrate and washings are evaporated on the water-bath in a vacuum until about 30 c.c. are left; on cooling, any oxalic acid will crystallise, and may then be further identified. The author has not as yet succeeded in detecting oxalic acid in commercial hydrogen peroxide.

L. DE K.

**Probable Errors of Analysis resulting from the Presence of Salicylic Acid in Strawberries.** By L. PORTES and A. DES-MOULIÈRES (*J. Pharm.*, 1901, [vi], 14, 342—351).—Compare this vol., ii, 40.

**New Process for the Detection and Estimation of Salicylic Acid.** By HENRI PELLET (*Ann. Chim. anal. appl.*, 1901, 6, 364—365).—Twenty c.c. of the liquid to be tested are acidified and boiled down in a beaker and from time to time a cold stirrer is held over the liquid so as to condense the vapour, which is then tested for salicylic acid by dropping it on a slightly greased porcelain slab on which are placed minute drops of ferric chloride. The author has noticed that no reaction will be obtained until the salicylic acid reaches the concentration of 0.06—0.07 gram per litre. Supposing, therefore, that the liquid has to be boiled down to 6 c.c. before the test is obtained, then the 20 c.c. contain  $10:6 = 0.0006$ —7 or about 0.0004 gram of salicylic acid. Liquids containing much salicylic acid must first be suitably diluted.

When dealing with wines, the process should be applied to the product resulting from the extraction of the wine with benzene.

L. DE K



## General and Physical Chemistry.

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**A Method for the production of Coloured Flames.** By STSCHEGLAYEW (*Zeit. physikal. Chem.*, 1901, 39, 111—113).—To obtain a flame coloured by a metallic salt, lasting for a considerable time in a steady state, the author suggests a blast of air blown horizontally into the surface layer of a saturated solution of the salt and then forming the air current of a bunsen burner. It is stated that if a motor be employed to yield a regular air stream at about 60 mm. pressure, most satisfactory results are obtained. L. M. J.

**Photographs of Spark Spectra. I. Ultra-violet Spark Spectra of Iron, Cobalt, Nickel, Ruthenium, Rhodium, Palladium, Osmium, Iridium, Platinum, Potassium Chromate, Potassium Permanganate, and Gold.** By WALTER E. ADENEY (*Trans. Roy. Dublin Soc.*, 1901, ii, 7, 331—338).—Reference must be made to the photographic reproductions accompanying the paper. In these, many lines observed by Eder and Valenta, as well as by Exner and Haschek, are absent, probably owing, in the majority of cases, to the different methods of sparking employed. J. C. P.

**Theory of Fluorescence.** By WOLDEMAR VOIGT (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 352—366).—Fluorescent and phosphorescent phenomena are due to free, incoherent vibrations within the excited substance. The author discusses the electron theory and from results so far obtained concludes that the molecules of fluorescing substances are capable of existing in two conditions, in which the electrons have different periods of vibration. The change from one state to the other is conditioned by molecular relationships, but an exciting light wave has also the power of aiding or starting the transition. The electrons pass into the new condition with speeds and elongations which are influenced by the motion given to them by the exciting wave in the old condition and they perform free, incoherent vibrations with a period corresponding with the new condition. The periods of vibration in the two conditions are very different and one is damped to a much greater extent than the other. J. McC.

**Chemical Effects produced by Radium Radiations.** By HENRI BECQUEREL (*Compt. rend.*, 1901, 133, 709—712).—Various chemical effects produced by radiations from radium have been already observed, as, for example, the action on silver gelatino-bromide, or barium platinoeyanide, destructive action on the skin, the coloration produced in rock salt, sylvite, and in varieties of glass or porcelain. The author has observed the following additional actions. (1) The transformation of yellow phosphorus into red, which may be brought about by immersing a sealed glass tube containing radium, enveloped in aluminium foil, into a glass vessel containing the phosphorus, the whole being kept in the dark. The transformation does not continue



after the removal of the radium. (2) The reduction of mercuric chloride by oxalic acid which takes place in the dark if the radium tube be placed in the mixed solutions. (3) Destruction of the germinative power of seeds by exposure to the radiation before planting. Mustard and cress seeds were divided into two portions, of which one was exposed for a week or more to the radiations; none of the seeds so exposed germinated, whilst of the others used for comparison, 80 per cent germinated. L. M. J.

**Induced Radioactivity excited by Radium Salts.** By P. CURIE and A. DEBIERNE (*Compt. rend.*, 1901, 133, 931—934. Compare Abstr., 1901, ii, 216, 298).—The phenomena of induced radioactivity excited by radium salts are more regular, and the activity is more intense, when an aqueous solution is used instead of the solid salt. The intensity of the induced activity is the same for all substances, whatever their chemical nature, under the same conditions, and is independent of the pressure of the gas surrounding the exciting and excited bodies. The induced radiation, like the exciting radiation, consists of some rays which are deflected in a magnetic field and some which are not. Other conditions being the same, the intensity of the induced radiation depends on the free space in front of the excited body; if, for example, several copper plates are placed parallel with one another and about 1 mm. apart, they acquire little activity, but if about 30 mm. apart they all become strongly active. The intensity of the radioactivity which can be excited in a given enclosure depends only on the quantity of radium introduced into it in the form of a solution. The glass of the enclosing vessel generally becomes luminous, and the luminosity finally acquired by any part of the vessel is independent of the position of the radium solution. If a radium solution and zinc sulphide are placed in separate flasks connected by a glass tube bent twice at right angles, the sulphide becomes and remains phosphorescent, and at the same time exhibits radioactivity, the intensity of the activity being independent of the phosphorescence and equal to that which would be acquired by any other substance under the same conditions. C. H. B.

**Influence of Radioactive Substances on the Luminescence of Gases.** By ALEXANDER DE HEMPTINNE (*Compt. rend.*, 1901, 133, 934—935).—Gases subjected to the influence of radioactive substances become luminous under the electric discharge at higher pressures than under normal conditions. In this respect, the Becquerel rays, therefore, resemble Röntgen rays; in both cases also the phenomenon is more marked the higher the molecular weight of the gas. C. H. B.

**Electromotive Efficiency of the Elementary Gases. II.** Note by EMIL BOSE (*Zeit. physikal. Chem.*, 1901, 39, 114).—A note in which the author acknowledges priority of Richarz regarding some points of his work on this subject (Abstr., 1901, ii, 589). L. M. J.

**Observations on the Determination of Transport Numbers of the Ions during Electrolysis of their Solutions. The Behaviour of Diaphragms during the Electrolysis.** By WILHELM HITTORF (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 671—688).—The

transport numbers recently determined do not in all cases agree with the early determinations of the author, and the divergence is greater than can be accounted for by experimental error. This led the author to an examination of the influence of diaphragms of porous porcelain, fine silk, and animal membrane in the conductivity cell. These diaphragms are used to keep the concentration of the electrolyte in the middle unchanged by preventing diffusion. In the case of copper sulphate, silver nitrate, and the chlorides of potassium, ammonium, sodium, barium, calcium, magnesium, and cadmium, the transport number is the same whether no diaphragm or one of silk or porous porcelain be used. With cadmium chloride, when animal membrane is used, the transport number of the cation is smaller than when no diaphragm is used. The animal membrane has the power of separating the solution into a more and a less concentrated part, and the less concentrated solution goes in the direction of the negative current, in this way leaving the solution round the cathode more dilute than it would be if no diaphragm were used. The use of animal membrane as diaphragm is without influence on the transport numbers of the ions of the chlorides of potassium, ammonium, and sodium. J. McC.

**Dissociation of certain Acids, Bases, and Salts at Different Temperatures.** By HARRY C. JONES and JAMES M. DOUGLAS (*Amer. Chem. J.*, 1901, 26, 428—453).—The substances investigated were hydrochloric, nitric, and sulphuric acids, potassium hydroxide, chloride, bromide, iodide, nitrate, sulphate and permanganate, sodium nitrate and ammonium nitrate. The temperature coefficient of conductivity increases (1) with dilution for acids, bases, and salts; (2) with rise of temperature for salts; in the case of acids and bases, change of temperature has no appreciable effect on the temperature coefficient of conductivity. The amount of dissociation in solutions of the above substances, as measured by the conductivity, is independent of the temperature. This fact, in conjunction with the observation that the conductivity of the solutions increases with the temperature, shows that rise of temperature affects the velocities of the ions. J. C. P.

**Effect of Temperature and Moisture on the Emanation of Phosphorus, and a Distinction in the Behaviour of Nuclei and of Ions.** By CARL BARUS (*Amer. J. Sci.*, 1901, [iv], 12, 327—346).—A physical paper dealing with the ionisation of air by its passage over phosphorus at various temperatures. J. C. P.

**Pressure as Supplement to Temperature in the Phenomenon of Inflammation.** By WALTÈRE SPRING (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 257—261).—No combination took place on subjecting an intimate mixture of 2 mols. of cupric oxide and 3 mols. of sulphur to a pressure of 10,000 atmospheres. Combination took place violently when the pressure on a mixture of 2 mols. of cuprous oxide and 3 mols. of sulphur rose to 8000 atmospheres; the pressure was increased gradually so that no heating by compression took place. Sulphur dioxide was formed and the residue consisted only of cuprous sulphide ( $2\text{Cu}_2\text{O} + 3\text{S} = 2\text{Cu}_2\text{S} + \text{SO}_2$ ). The ignition temperature of this

mixture at the ordinary pressure is about  $126^{\circ}$ , and pressure to the extent of 8000 atmospheres has the effect of lowering this by more than  $100^{\circ}$ . The ignition temperature of the mixture of cupric oxide and sulphur could not be determined for the sulphur inflamed at  $250^{\circ}$ , but it must be higher than this. It would appear that the point of inflammation is a function of the pressure, and the experiments are being continued to ascertain if this is quite general. J. McC.

**Isotherms for Mixtures of Hydrogen Chloride and Ethane.** By N. QUINT GZN (*Zeit. physikal. Chem.*, 1901, 39, 14—26).—Isotherms for hydrogen chloride, ethane, and mixtures containing 86.82, 59.68, 38.33, and 28.59 per cent. of hydrogen chloride respectively, were determined at temperatures from  $15^{\circ}$  to  $55^{\circ}$  and the critical phenomena investigated. The mixtures behave very similarly to the mixture of nitrous oxide and ethane investigated by Kuenen (*Abstr.*, 1896, ii, 10), and the author uses his results to test the validity of van der Waals' expression in the case of mixtures. Satisfactory agreement between calculated and observed numbers is obtained.

L. M. J.

**Minimum Value of the Total Heat of Combination.** By ROBERT DE FORCRAND (*Compt. rend.*, 1901, 133, 681—684).—The author has previously enunciated the relation  $(L+S)/T=30$ , or, in the case of a dissociative change in which a gas is produced,  $(L+S+q)/T=30$ , where  $q$  is the heat of combination. In the case of a gas and a dissociable compound of this gas, therefore,  $(L+S)/T = (L+S+q)/T' = 30$ , hence  $q/(T'-T)=30$ , that is, the heat of combination is proportional to the elevation of the boiling point, and when  $T'-T$  is small,  $L+S+q$  (or the total heat of combination,  $Q$ ) approximates to  $L+S$ . This deduction is tested chiefly by examples of compounds of ammonia with metallic salts, in which the value  $T'$  is but slightly greater than  $234.5^{\circ}$ , the boiling point of ammonia, for each of which also the total heat of combination is about 7 to 8 Cal., the value  $L+S$  for ammonia being calculated as 7.03 Cal. (*Abstr.*, 1901, ii, 372, 594). L. M. J.

**Determination of the Heat of Dissociation and of Combustion of Acetylene, Ethylene, and Methane.** By WILLIAM G. MIXTER (*Amer. J. Sci.*, 1901, [iv], 12, 347—357).—The heat of dissociation of acetylene is found by explosion in a bomb to be 53300 cal. (Thomsen, 47770 cal.; Berthelot, 51400 cal.); the heat of combustion of acetylene is 313800 cal. (Thomsen, 310050 cal.; Berthelot, 315700 cal.). The heat of dissociation of ethylene was found by exploding a mixture of ethylene and acetylene, and subtracting the thermal effect due to the acetylene; the author's results vary a good deal, but indicate that ethylene may be more endothermic than has been supposed. The heat of combustion of ethylene is 345800 cal. (Thomsen, 333350 cal.; Berthelot, 341100 cal.). The heat of dissociation of methane, determined in the manner described for ethylene, is found to be -19000 cal. (Thomsen, -21170 cal.; Berthelot, -21500 cal.).

J. C. P.

**New Method of representing Heats of Solution.** By HENDRIK W. BAKHUIS ROOZEBOOM (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 430—441).—The heat of solution can best be represented diagrammatically by referring the concentration of the solution, not as is usually done, to the number of mols. of solvent per mol. of dissolved substance, but so that the sum of the number of molecules of solvent and dissolved substance is equal to unity (or 100). The advantage gained is that the curve obtained is a complete one and does not run to infinity. Three forms of curve for heat of mixture of liquid components are known: (1) positive heats only; (2) negative heats only; (3) positive and negative heats according to the relative quantities of the components. The heat of solution of solid substances can be easily obtained from these heat of mixture curves if the heat of fusion is known, and from them also can be deduced the theoretical heat of solution, that is, the heat change which occurs when 1 mol. of salt is dissolved in an infinite quantity of its saturated solution. J. McC.

**Fusion and Crystallisation. The Theory of Tammann.** By PIERRE DUHEM (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 93—102).—According to the Clausius formula  $dT/dP = 1/E \cdot T/L \cdot (v' - v)$  for the variation of the point of fusion with the pressure, in which  $P$  is the pressure,  $T$  the fusion point at pressure  $P$ ,  $L$  the heat of fusion at pressure  $P$  and temperature  $T$ ,  $v$  the specific volume of the crystalline phase at  $P$  and  $T$ ,  $v'$  the specific volume of the isotropic phase at  $P$  and  $T$ , and  $E$  the mechanical equivalent of heat, since the values of  $1/E$  and  $T/L$  are positive, the sign of  $dT/dP$  must be the same as that of  $(v' - v)$ . It is probable that for some substances the value of  $(v' - v)$  is positive up to a maximum value of  $P$ , then assumes the value 0, and finally becomes negative; in these cases, the curve of fusion is concave towards the pressure axis on a system of coordinates.

Tammann has found that when an isotropic phase is gradually cooled, the tendency to crystallise is small just below the fusion point; it increases to a maximum as the temperature falls and at low temperatures again becomes small. Tammann interprets this by assuming that if the temperature be lowered sufficiently and the pressure kept constant, a second fusion point is reached, that is, a second temperature at which the isotropic and the crystalline phases are in equilibrium. The author shows that the phenomena can be better explained by assuming, instead of a curve of second fusion, a *line of false equilibrium*. Tammann's view assumes that there will always be a line along which  $(v' - v) = 0$ , and a line along which  $L = 0$ . The new view does not necessitate these lines, which, indeed, are in some cases difficult to admit. J. McC.

**Folding Point Curves in Ternary Systems.** By FRANZ A. H. SCHREINEMAKERS (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 170—192. Compare Abstr., 1901, ii, 224, 305, 372, 436, 641).—The author continues the discussion of the vapour pressure of ternary mixtures. A folding point indicates a critical solution, as in this point two liquid layers must be identical. The conditions for critical liquids of the first and second order are developed, and it is shown that if on the curve of



a critical liquid of the first order under constant pressure there rests a critical liquid of the second order, then at the point of contact the temperature must be either a maximum or a minimum. The author develops a formula by means of which it can be foretold whether the temperature at which two liquid layers are identical is raised or lowered by addition of a third component. A critical liquid at a given temperature can only be in equilibrium with vapour at a certain definite pressure, and change of temperature alters, not only the pressure, but also the composition of both liquid and vapour. The effect of change of pressure is also fully discussed. J. McC.

**An Equation for Osmotic Pressure in Concentrated Solution.** By C. H. WIND (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 714—726).—From considerations similar to those employed by van der Waals in the development of the gas equation of condition, the author deduces the equation of condition in concentrated solution,  $RT = [N + (a - a')/V^2] [V - \theta b^2/V]$ , as a more complete statement of van't Hoff's law.  $N$  is the osmotic pressure,  $V$  the total volume of the system, and  $a$ ,  $a'$ ,  $b$  and  $\theta$  are constants. This equation differs from that of van der Waals inasmuch as the pressure correction may be negative (if  $a'$  is greater than  $a$ ) and in that the volume correction contains  $V$  in the denominator. The equation correctly expresses the results obtained by Ewan (Abstr., 1900, ii, 195) and by Byl (*Proefschrift, Amsterdam*, 1901). J. McC.

**Neutral Salts.** By KURT ARNDT (*Zeit. anorg. Chem.*, 1901, 28, 364—370).—The degree of dissociation of 0.1*N* solutions of the following are: HCl, 0.91; HNO<sub>3</sub>, 0.92;  $\frac{1}{2}$ H<sub>2</sub>SO<sub>4</sub>, 0.58; KOH, 0.89; NaOH, 0.84. In solutions of chloride and nitrate of potassium and sodium, there will be about the same quantity of hydrogen and hydroxyl ions produced by hydrolysis. Since sulphuric acid is less dissociated than potassium or sodium hydroxides, in the solution of the sulphates there will be a slight excess of hydroxyl ions. This excess is too small to be detected by indicators, but the influence of potassium sulphate on the catalysis of ethyl acetate is very different from that of chlorides or nitrates and resembles that of alkalis (Arrhenius, Abstr., 1888, i, 340). The inversion of sucrose by hydrochloric acid is increased by addition of chlorides; the inversion by sulphuric acid is diminished by potassium or sodium sulphate (Spohr, Abstr., 1885, 1181). The small quantity of the hydroxyl ion can be even more sharply detected by its influence on the birotation of dextrose. The influence of sulphates on the rotation of dextrose is similar to that of weak bases (Levy, Abstr., 1895, i, 586; Trey, Abstr., 1897, ii, 299).

J. McC.

**Velocity of Solution of Solid Substances. II.** By LUDWIK BRUNER and STANISLAW TOLLOCZKO (*Zeit. anorg. Chem.*, 1901, 28, 314—330. Compare Abstr., 1901, ii, 10).—Experiments on the velocity of solution of benzoic acid cast into a cake and rotated in water show that some of the solid is mechanically rubbed off and becomes suspended in the solution. Drucker's results (Abstr., 1901, ii, 376) are vitiated by this circumstance. From experiments with



alabaster, it is proved that the rate of rotation of the plate has a great influence on the velocity of solution, but the volume of the liquid used is without influence. Hydrogen ions are without influence on the speed of solution of calcium sulphate. The velocity of solution is dependent on the structure of the solid substance, smooth gypsum crystals being dissolved more slowly than the granular alabaster.

J. McC.

**The Investigation of Complex Compounds.** By GUIDO BODLÄNDER (*Chem. Centr.*, 1901, ii, 1109—1111; from *Sonderabdruck aus der Festschr. zur Feier des-siebzigsten Geburtstages Richard Dedekind*, 153—182).—Complex compounds are often formed in solution by the combination of a sparingly soluble compound with a molecule or an ion of a soluble one. In some cases, as, for instance, when silver cyanide dissolves in solutions containing cyanogen ions, the quantity of the more insoluble compound which goes into solution is equivalent to that of the soluble compound, whilst in others, the proportions vary with the quantities present. The solution of silver chloride by ammonia or of cuprous chloride by hydrochloric acid is an example of the latter type. In such cases, the law of mass action may be applied, and an indication of the composition of the dissolved ions may be derived from the solubility of the less soluble in an excess of the soluble component. Assuming, for instance, the formula  $\text{Cu}_m\text{Cl}_{m+n}$  to represent the complex ions in a solution of cuprous chloride in presence of a soluble chloride, then  $(\text{CuCl})^m\text{Cl}^n = \text{Cu}_m\text{Cl}_{m+n}k$ , and since the quantity of active cuprous chloride is constant,  $\text{Cl}^n = \text{Cu}_m\text{Cl}_{m+n}k_2$ . This gives no indication, however, of the value of  $m$ , for if  $n=2$  then the formula of the complex ions may be  $\text{CuCl}_3$ ,  $\text{Cu}_2\text{Cl}_4$ , or  $\text{Cu}_3\text{Cl}_5$ , &c. The formula of the complex ions may be calculated from measurements of the *E.M.F.* between electrodes of the same metal as that in the complex in a concentration cell containing two solutions which must have either the same concentration in respect of the complex and different concentrations of the soluble component or *vice versa*. The *E.M.F.* between silver electrodes immersed in solutions containing equal quantities of silver but unequal quantities of ammonia may be calculated from the law of mass action. Assuming the formula of the complex ions to be  $\text{Ag}_m(\text{NH}_3)_n$ , then  $k[\text{Ag}_m(\text{NH}_3)_n] = \text{Ag}^m(\text{NH}_3)^n$  for one solution and  $k[\text{Ag}_m(\text{NH}_3)_n]_1 = \text{Ag}_1^m(\text{NH}_3)_1^n$  for the other. Since the concentration of the complex ions is the same in both solutions,  $(\text{Ag}:\text{Ag}_1)^m = [(\text{NH}_3)_1:(\text{NH}_3)]^n$ .

Neglecting the difference of potential at the boundary of the two solutions, then the *E.M.F.* is

$$E = 0.058 \log(\text{Ag}:\text{Ag}_1) = 0.058_{n,m} \log[(\text{NH}_3)_1:(\text{NH}_3)].$$

If the concentration of the free ammonia is the same in both solutions but that of the complex ions different, then :

$$[\text{Ag}_m(\text{NH}_3)_n]_1 : [\text{Ag}_m(\text{NH}_3)_n] = (\text{Ag}_1:\text{Ag})^m, \text{ and}$$

$$E_1 = 0.058 \log(\text{Ag}_1:\text{Ag}) = 0.058_m \log([\text{Ag}_m(\text{NH}_3)_n] : [\text{Ag}_m(\text{NH}_3)_n]_1).$$

Hence, from  $E$  and  $E_1$ ,  $m$  and  $n$  can be calculated.

It has been found by this method that silver chloride or silver nitrate in ammoniacal solution contains the ion  $\text{Ag}(\text{NH}_3)_2$ , cuprous oxide in ammoniacal solution the ion  $\text{Cu}(\text{NH}_3)_2$ , and cuprous chloride

in solutions of chlorides the ion  $\text{CuCl}_2$  or  $\text{CuCl}_3$ , according to the concentration.  
E. W. W.

**Dissolution of Metals.** By T. ERICSON-AURÉN and WILHELM PALMAER (*Zeit. physikal. Chem.*, 1901, 39, 1—13).—The law of mass action cannot be applied to calculate the velocity of dissolution of zinc in acids, as the values so calculated do not agree with the experimental results. The authors consider that dissolution is purely electrolytic and occurs solely as a result of local currents; to this is due the slow velocity of dissolution of pure metals. On this assumption, an expression is deduced for the rate of dissolution of a metal in acids of any concentration, the expression, however, involving an unknown quantity, the resistance capacity. This may, however, be deduced from one set of determinations and the velocity of dissolution under other conditions then calculated. The values so obtained were found to agree well with those determined experimentally. The temperature coefficient between  $10^\circ$  and  $50^\circ$  was found to be in general about 1.5 to 2 per cent. per degree. This is far smaller than the usual temperature coefficient of a chemical reaction, but is approximately that of the increase of *E.M.F.*, a result in accord with the theoretical views.  
L. M. J.

**Velocity of Decomposition of Ammonium Nitrite.** By KURT ARNDT (*Zeit. physikal. Chem.*, 1901, 39, 64—90).—The velocity of decomposition of aqueous solutions of ammonium nitrite was determined at temperatures varying from  $60^\circ$  to  $80^\circ$ , and at concentrations varying from 0.6 'molar' to 0.3 'molar.'\* It was found that in the solutions of the higher concentration the increase of temperature from  $60^\circ$  to  $80^\circ$  caused an increase in the rate of evolution of nitrogen from 0.37 c.c. per min. to 3.2 c.c. per min. It was observed that the addition of small quantities of acid increases to a very great extent the velocity of decomposition, whilst ammonia causes an equally marked decrease. This suggested that the decomposition is really due to interaction between the ammonium nitrite and nitrous acid produced by hydrolytic dissociation. From the effect of the addition of sulphuric acid, it was calculated, on this assumption, that the hydrolytic dissociation is about 0.25 per cent. at  $70^\circ$ , a value which agreed with that calculated from the effect of the addition of ammonia. Ammonium sulphate increases the velocity, probably owing to the increase of undissociated ammonium nitrite, whilst sodium nitrite, by increasing also the free nitrous acid, causes a more marked increase of the velocity. The addition of other neutral salts causes, as expected, a decrease of the decomposition. That the decomposition is not a simple change is also indicated by the approximate proportionality of the velocity to the third power of the concentration.  
L. M. J.

**Equilibrium between Carbonates and Bicarbonates in Aqueous Solution.** By FRANK K. CAMERON and LYMAN J. BRIGGS (*J. Physical Chem.*, 1901, 5, 537—555).—Solutions of sodium carbonate or

\* The term 'molar' is used by the author to indicate the molecular weight of a substance in grams per litre.

of hydrogen sodium carbonate attain a state of equilibrium in which both salts are present, the composition being dependent on the total concentration, the temperature, and the pressure of carbon dioxide in the vapour phase. The concentration of the two salts in solution was determined by titration with hydrogen potassium sulphate with (1) phenolphthalein, (2) methyl-orange as indicator. Curves are given which show the percentage present as normal carbonate at different concentrations and temperatures. At all temperatures, the quantity of normal salt rapidly increases with the concentration until a concentration of about 0.4*N*, when it remains almost constant; the proportion of normal carbonate also increases with rise of temperature. In certain solutions, the author considers a maximum in the curve is indicated, but fuller examination is deferred. Solutions of potassium carbonate gave perfectly analogous results. Calcium carbonate exists in solution almost entirely as the hydrogen salt, but solutions of magnesium carbonate may contain 50 per cent. of the normal salt. In both cases, the equilibrium and total solubility are greatly affected by the pressure of the carbon dioxide.

L. M. J.

**Precipitation of Colloids by Electrolytes.** By WILLIS R. WHITNEY and J. E. OBER (*J. Amer. Chem. Soc.*, 1901, 23, 842—863).—When 30 c.c. of a 1 per cent. solution of barium chloride were added to 200 c.c. of a 1 per cent. colloidal arsenious sulphide solution, complete precipitation of the arsenious sulphide immediately occurred; it was found that the precipitate contained 0.0152 gram of barium and that an equivalent amount of hydrogen chloride had been produced. By employing an arsenious sulphide solution of half the above strength, it was shown that the composition of the precipitated colloid is independent both of the concentration of its solution and of that of the barium salt. Experiments in which the chlorides of calcium, strontium, and potassium were used showed that the precipitated colloid contained the metals, barium, strontium, calcium, or potassium in the proportions of their equivalent weights; this result supports Whetham's hypothesis (*Abstr.*, 1900, ii, 62).

An index to the literature of colloids is appended.

E. G.

**The Standard for Atomic Weights.** By THEODOR W. RICHARDS (*Zeit. anorg. Chem.*, 1901, 28, 355—360. Compare *Abstr.*, 1901, ii, 231, 379).—The author supports the proposal of the International Commission to take as standard  $O=16$ . On pedagogic grounds, objection cannot be taken to this if, in the development of Avogadro's rule, use is made of the densities (experimental) of the gases, that is, the actual weights of 1 litre of the various gases at 0°, instead of "specific gravities."

J. McC.

**Mathematical Expression of the Periodic Law.** By S. H. HARRIS (*J. Physical Chem.*, 1901, 5, 577—586).—The author shows sundry connections between the atomic weights of elements in different series and calculates the atomic weights of a number of unknown elements to fill the blank spaces in the periodic table.

L. M. J.

**Purification of Gases.** By L. E. O. DE VISSER (*Rec. Trav. Chim.*, 1901, [ii], 20, 388—393).—Stas has frequently emphasised the

incomplete purification of gases effected by passing them through tubes containing absorbent solids or liquids; a complete purification can, however, easily be obtained by passing the gas first through a layer of cotton wool which has previously been impregnated with a solution of the absorbent solid and dried in the air and subsequently through closely packed, pure cotton. If the gas attacks the latter, asbestos or fine-threaded glass wool may be used. In this way, carbon dioxide, generated from marble and hydrochloric acid, can be entirely freed from hydrogen chloride, although Stas has shown the latter to be present in the gas purified by passage through aqueous and solid sodium hydrogen carbonate.

W. A. D.

**A New Method of Manipulating Liquefied Gases in Sealed Tubes.** By HENRI MOISSAN (*Compt. rend.*, 1901, 133, 768—771).—When a current of air at  $18^{\circ}$  is passed through a mixture of solid carbon dioxide and ethyl or methyl alcohol, the temperature obtained is constantly  $-85^{\circ}$ ; with methyl chloride or aldehyde,  $-90^{\circ}$ ; with ethyl acetate,  $-95^{\circ}$ , and with acetone,  $-98^{\circ}$ . If the current of air is previously cooled to  $-80^{\circ}$ , the temperature obtained with the solid dioxide and acetone is  $-110^{\circ}$ . For lower temperatures, recourse must be had to liquid air or liquid oxygen.

When liquefied gases have to be sealed up in glass tubes, the operation is greatly simplified by first cooling the tube, so that the gas becomes solid. For a pressure of 200 atmos., the tube should be of 10 mm. external and 6 mm. internal diameter; for higher pressures, 7 mm. external and 3 mm. internal diameter; and for pressures as high as 300 atmos., 6 mm. external and 1.5 mm. internal diameter. The method is applicable when the liquefied gas is to act on some other substance, and if, after the reaction is finished, the tube is again strongly cooled before being opened, the products of the reaction can be distilled off fractionally. The method is not, however, applicable to reactions in which hydrogen is liberated. The author calls attention to the importance of allowing glass tubes which have been strongly cooled to return very slowly to the ordinary temperature.

C. H. B.

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## Inorganic Chemistry.

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**Place of Hydrogen in the Periodic System.** By BOHUSLAV BRAUNER (*Chem. News*, 1901, 84, 233—234).—A theoretical paper dealing mainly with the question as to whether hydrogen should be regarded as the first member of the halogen group, or whether the old view that it should stand at the head of the first group is still most in accordance with facts.

D. A. L.

**Positive and Negative Halogen Ions.** By JULIUS STIEGLITZ (*J. Amer. Chem. Soc.*, 1901, 23, 797—799).—Attention is drawn to



the existence of positive chlorine ions in aqueous solutions of chlorine and hypochlorous acid, experimental proof of which is furnished by the work of Jakowkin (*Abstr.*, 1899, ii, 736). E. G.

**Formation of Ozone.** By ALBERT LADENBURG (*Ber.*, 1901, 34, 3849—3851).—In preparing ozone by means of the 'silent discharge,' the proportion of ozone reaches a maximum for intermediate values of the current strength, but increases progressively with falling temperature. The maximum percentage recorded is 10.79. T. M. L.

**Production of Ozone.** By A. CHASSY (*Compt. rend.*, 1901, 133, 789—791).—The quantity of ozone formed in a Berthelot's apparatus at 20° increases with the time, according to a law which is independent of the intensity of the discharge. The curve representing the rate of increase is asymptotic to a line parallel with the axis of time, and the quantity of ozone formed tends towards a limit which depends on the temperature and is independent of the intensity of the discharge. The formation of a given quantity of ozone requires less expenditure of energy in the form of electric discharge when the percentage of ozone is low than when it is high. C. H. B.

**Decomposition of Potassium Iodide Solutions by Ozone.** By KARL GARZAROLLI-THURNLACKH (*Monatsh.*, 1901, 22, 955—975. Compare Brunck, *Abstr.*, 1900, ii, 572; Péchard, *Abstr.*, 1900, ii, 536).—In the product obtained by the action of ozone on solutions of potassium iodide, the amount of iodine which could be extracted by carbon disulphide was determined by titration with potassium arsenite; the iodine present as hypoiodite or other compound and the total iodine were also estimated. When a concentrated solution of potassium iodide has been exposed to the action of ozone for five minutes, the solution contains iodine, hypoiodite, iodate, periodate, and potassium hydroxide. Further changes then take place, the quantity of hypoiodite and periodate gradually decreases, the former ultimately disappearing, whilst the amounts of iodine, potassium hydroxide, and iodate increase. Conditions more favourable for the formation of periodate, but less favourable for that of hypoiodite, are obtained by passing the ozone into the solution of the iodide. Attempts to obtain direct evidence of the presence of potassium peroxide or hydrogen peroxide failed, however. The fume which is formed when ozone acts on potassium iodide contains an iodine oxide which is attacked by potassium arsenite.

By the action of ozone on a solution of potassium bromide, hypobromite and bromate are formed together with some bromine.

E. W. W.

**Pure Tellurium and its Atomic Weight.** By PAUL KÖTHNER (*Annalen*, 1901, 319, 1—58).—The communication contains a bibliography of the subject and a discussion of the relationship of tellurium to its neighbouring elements in the periodic classification. Tellurium may be separated from its common impurities (copper, silver, gold,

bismuth, antimony, arsenic, and selenium) by dissolving the crude substance in hydrochloric acid containing a little nitric acid, evaporating off the excess of the latter reagent, diluting the cooled solution with water until the deep yellow colour of tellurium tetrachloride disappears, filtering from the precipitate of silver chloride and the oxychlorides of antimony and bismuth, and treating the warm filtrate with sulphur dioxide. The precipitated metalloid is again subjected to the foregoing treatment and fractionally precipitated by the reducing agent. Three fractions are employed, and after repeating the operation two or three times the middle fraction consists of pure tellurium; the first portions contain arsenic, whilst the third fraction shows traces of copper and gold. The element may be obtained in a crystalline form by passing sulphur dioxide into a hot solution of the tetrachloride in concentrated hydrochloric acid (20.3 per cent.); the crystals being opaque with a silvery lustre.

Telluric acid, prepared by Staudenmaier's method (Abstr., 1896, ii, 96), even after repeated crystallisation, exhibits, in its spectrum, lines characteristic of silver, copper, and antimony.

The basic nitrate,  $\text{OH} \cdot \text{TeO} \cdot \text{O} \cdot \text{TeO} \cdot \text{ONO}_2$ , employed by Norris, Fay, and Edgerly (Abstr., 1900, ii, 272), is conveniently prepared by dissolving small quantities of tellurium in a slight excess of nitric acid and evaporating the solution obtained from several experiments. In this way, the separation of tellurium is reduced to a minimum. This salt, however, even after repeated crystallisation, still contains traces of silver and copper.

Tellurium can be separated from all other elements except antimony by distillation in a vacuum, and since this element is removed in purifying the basic nitrate, it follows that a combination of the two processes should lead to the production of pure tellurium. The product obtained by reducing the recrystallised nitrate with sulphur dioxide is distilled under 9—12 mm. pressure in a tube divided into segments by asbestos partitions. After repeated distillation through three or four of these compartments, a specimen is obtained which is quite free from impurities. The spectrum of this product agrees in every respect with that of the element prepared from diphenyl telluride (Steiner, Abstr., 1901, ii, 235, 236).

The foregoing method is more readily carried out and is far less wasteful than that based on fractional precipitation with sulphur dioxide.

Telluric acid,  $\text{Te}(\text{OH})_6$ , the basic sulphate,  $2\text{TeO}_2 \cdot \text{SO}_3$ , and the double chlorides with ammonium and rubidium are not suitable for the atomic weight determination, the compound finally selected being the recrystallised basic nitrate. The atomic proportions of tellurium and nitrogen were determined by decomposing the basic nitrate in a modified Dumas apparatus and estimating the nitrogen, water, and residual tellurium dioxide. In this way, three experiments gave a mean atomic weight of 126.8; the method, however, is open to objection, owing to the errors incidental to the absolute method of estimating nitrogen.

The atomic weight was finally obtained with greater accuracy by heating the pure salt and weighing the dioxide. The results of seven

determinations which were very concordant showed that tellurium, obtained by the author's process, has an atomic weight of 126.7 ( $H=1$ ) or 127.88 ( $O=16$ ). The ultra-violet spectrum seems to be the best criterion of the purity of the tellurium, and photographs of the spectra of different preparations are included in the communication. G. T. M.

**Experiments on the Atomic Weight of Tellurium.** By GIOVANNI PELLINI (*Ber.*, 1901, 34, 3807—3810).—To purify the tellurium, diphenyl telluride was repeatedly fractionated under diminished pressure and then converted into the dibromide, which was purified by recrystallisation from benzene and then oxidised to telluric acid. The tellurium obtained from the acid was distilled in a vacuum. For the atomic weight determinations, tellurium was in one series oxidised by nitric acid to dioxide; in another series, the dioxide was reduced to tellurium in a current of hydrogen. The mean value of six determinations in the first series was 127.65 (maximum 128.05, minimum 127.41); in the second series, the mean value of three determinations was 127.62 (maximum 128.02, minimum 127.30) when  $O=16$ . K. J. P. O.

**Preparation of Nitrogen from Ammonium Nitrate.** By JUL. MAI (*Ber.*, 1901, 34, 3805—3806).—On heating a mixture of glycerol (2 parts) and ammonium nitrate (1 part) at  $190^{\circ}$ , a reaction begins, which continues without further application of heat until the temperature has fallen to  $150^{\circ}$ . The gas evolved is mainly nitrogen mixed with a small quantity of carbon dioxide. The reaction begins at a lower temperature, and the gas is evolved more regularly if 2 or 3 drops of concentrated sulphuric acid are added to the mixture. The glycerol is oxidised to glyceric acid and at the same time a very small amount of pyridine bases is formed. From 10 grams of ammonium nitrate, 2690 c.c. of nitrogen were obtained instead of 2775 c.c. theoretically possible (at *N.T.P.*). K. J. P. O.

**The Condition Diagram for Phosphonium Chloride.** By GUSTAV TAMMANN (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 244—256).—The melting curve of phosphonium chloride is given by the equation:  $t = 28.5 + 0.0329 (p - 50) - 0.00000366 (p - 50)^2$  up to a pressure of 1550 kilos., and above this by  $t = 28.5 + 0.0295 (p - 50) - 0.00000159 (p - 50)^2$ . The change of volume on fusion was determined by the method already described (*Abstr.*, 1900, ii, 714); at the triple point, the change in volume amounts to 0.87 c.c. per gram, that is five times greater than the greatest (naphthalene) known up to the present. The calculated heat of fusion, 180 cal. per gram, is more than double that of water, and the high value is probably due to the fact that phosphonium chloride does not melt without dissociation. Phosphonium chloride exists at low temperatures as a white (amorphous?) mass; at higher temperatures, in clear crystals. The transition point is near  $-41^{\circ}$  and the crystals (supercooled) have the higher vapour pressure. Phosphonium chloride can be obtained in the hypercritical condition, which was found to be impossible in the case of carbon dioxide (*Abstr.*, 1899, ii, 635). J. McC.

**Oxidation of Boron to Silica and Reduction of Boric Acid to Silicic Acid.** By FRIEDRICH FITTICA (*Chem. Zeit.*, 1901, 25, 929—930).—It is claimed that when amorphous boron is oxidised with barium peroxide, with potassium chlorate and sulphuric acid, or with other oxidising agents, considerable amounts of silica are formed, and also that when boric acid is reduced by the addition of sodium to a solution of boric acid in strong alkali or by the aid of zinc dust, silicic acid is formed. It is suggested that  $B_4 = SiO$ . J. J. S.

**The Supposed Conversion of Boron into Silica and of Boric Acid into Silicic Acid.** By CONSTANTIN COUNCLER (*Chem. Zeit.*, 1901, 25, 977—978).—A criticism on Fittica's communication (preceding abstract). J. J. S.

**Oxidation of Boron and Reduction of Boric Acid to Silicon Compounds.** By FRIEDRICH FITTICA (*Chem. Zeit.*, 1901, 25, 978).—A reply to Councler (preceding abstract). J. J. S.

**Influence of High Temperature on the Texture of the Hydrogel of Silicic Acid.** By JACOBUS M. VAN BEMMELEN (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 607—624. Compare Abstr., 1897, ii, 137; 1899, ii, 12, 84).—The hydrogel of silicic acid when ignited loses its power of absorbing water. Ignition for a short time causes only partial loss of this power, and the water which is then absorbed merely fills up the spaces in the network of the silica. Prolonged ignition causes the complete disappearance of these spaces, with consequent contraction of the whole mass.

The sp. gr. after ignition is 2.2; the sp. gr. of the material forming the network of the hydrogel is higher than this (2.5—3.0), which indicates that the substance expands when dehydrated. J. McC.

**Direct Conversion of Gas Carbon into Diamond.** By ALBERT LUDWIG (*Chem. Zeit.*, 1901, 25, 979—980).—Diamond crystals are formed when an electric current is passed through an iron spiral embedded in powdered gas carbon and surrounded by an atmosphere of hydrogen under great pressure. The same transformation occurs in the absence of iron, but a much higher temperature is required.

J. J. S.

**Decomposition of the Chlorides of Alkali Metals.** By C. W. VOLNEY (*J. Amer. Chem. Soc.*, 1901, 23, 820—824).—When sodium chloride (1 mol.) is treated at 18° with sulphuric acid (1 mol.) of sp. gr. 1.84, the following reaction takes place without any development of heat:  $2NaCl + 2H_2SO_4 = NaHSO_4, H_2SO_4 + HCl + NaCl$ . On heating the residue to 120°, a further quantity of hydrogen chloride is evolved, in accordance with the equation:  $NaHSO_4, H_2SO_4 + NaCl = 2NaHSO_4 + HCl$ . When potassium chloride is treated with concentrated sulphuric acid at 17—18°, the temperature rises to 30° and then gradually falls to 17°, whilst in the case of ammonium chloride under the same conditions the temperature rapidly falls from 18° to 1°.

E. G.



**Electrolysis of Ammonium Chloride [and Ammonium Iodide] in Solution in Liquefied Ammonia.** By HENRI MOISSAN (*Compt. rend.*, 1901, 133, 713—714. Compare Abstr., 1899, i, 410; ii, 152).—The electrolysis of ammonium chloride, bromide, and iodide in solution in carefully dried liquefied ammonia was carried out in a U-tube of glass, platinum electrodes being used (compare Ruff, Abstr., 1901, ii, 653). At  $-50^{\circ}$ , the iodide was very soluble, the bromide moderately, the chloride little, soluble, and ammonium fluoride nearly insoluble in liquefied ammonia.

Liquefied ammonia, prepared with care, is practically a non-conductor (Frenzel, Abstr., 1900, ii, 474). When ammonium chloride is dissolved in it, chlorine is evolved at the anode, and at  $-60^{\circ}$  to  $-80^{\circ}$  is free from nitrogen; at the same time, the liquid becomes yellow from the presence of dissolved chlorine; no chloride of nitrogen is produced. Pure hydrogen is evolved continuously at the cathode. In the case of a solution of ammonium iodide, iodine is deposited at the anode, and does not react with, or dissolve in, the liquid ammonia at  $-70^{\circ}$ , even after 24 hours. If the temperature is allowed to rise, the iodine crystals disappear and a very heavy, dark-coloured liquid is formed, which falls to the bottom of the tube (compare Hugot, Abstr., 1900, ii, 274).  
K. J. P. O.

**Study of Ammonium Amalgam.** By HENRI MOISSAN (*Compt. rend.*, 1901, 133, 803—808).—The previous work on the existence of ammonium amalgam is discussed, and it is pointed out that the first problem is the accurate measurement of the ammonia and hydrogen evolved in the decomposition of the amalgam. To solve this problem, the author prepares the amalgam by acting on sodium amalgam with a solution of ammonium chloride (or ammonium iodide) in liquefied ammonia at  $-35^{\circ}$ ; sodium chloride (or iodide) and a metallic mass are rapidly formed; no gas is evolved. The liquid ammonia is poured off from the metal and the latter washed with liquid ammonia and finally with dry ether, saturated with hydrogen, and cooled to  $-80^{\circ}$ . At  $-80^{\circ}$ , the metal becomes very hard; at  $-40^{\circ}$ , it begins to liquefy, and at  $-30^{\circ}$  to increase in volume; at  $+15^{\circ}$ , the volume has increased twenty-five or thirty fold, and a characteristic pasty mass is formed. In the decomposition accompanying this increase in volume, heat is developed, and the temperature is raised  $5-6^{\circ}$  above the surroundings.

In order to measure the gases evolved in the decomposition, a portion of the metal, which was cooled to  $-80^{\circ}$ , was placed in a glass tube, which was then exhausted whilst the temperature was maintained between  $-80^{\circ}$  and  $-90^{\circ}$ . At this temperature, no decomposition took place during the exhaustion. The temperature was allowed to rise, and after twelve or fifteen hours, decomposition was complete. In all the experiments, the gas evolved consisted accurately of two volumes of ammonia and one of hydrogen. In some of the experiments, the cooled metal was washed with sulphuric acid or ether saturated with hydrogen chloride; although part of the amalgam was destroyed, the remainder gave up the same proportion of ammonia and hydrogen. The author, however, believes that the radicle ammonium is not present in the metal, but that an ammoniacal hydride is formed, for when an aqueous solution

of ammonia is caused to act on pasty sodium amalgam, hydrogen is slowly evolved, whilst if the amalgam contains sodium hydride, the metal immediately swells up and forms a pasty mass.

When hydrogen is passed over sodium heated at  $320^{\circ}$ , the gas is rapidly absorbed and a transparent, crystalline, hygroscopic hydride,  $\text{Na}_2\text{H}$ , is formed, which, as a powder, takes fire in air or oxygen, and in chlorine (Troost and Hautefeuille, *Abstr.*, 1874, 767). When heated in a vacuum, the hydride decomposes into sodium and hydrogen. The hydride can be readily separated from excess of metallic sodium by treating the mixture with dry liquid ammonia, when the sodium dissolves as sodium-ammonium, leaving the pure hydride. K. J. P. O.

**Decomposition of Calcium-Ammonium and of Lithium-Ammonium by Ammonium Chloride.** By HENRI MOISSAN (*Compt. rend.*, 1901, 133, 715—717. Compare *Abstr.*, 1901, ii, 600, 653).—In order to ascertain if ammonium is capable of existing at about  $-100^{\circ}$ , the author has caused calcium-ammonium ( $\text{Ca}[\text{NH}_3]_4$ ) to interact with ammonium chloride in the presence of liquefied ammonia. Pure, dry ammonia was led over a known weight of calcium contained in a U-tube, one of the arms of which was constricted. A crystal of dry ammonium chloride was placed in the constriction. On cooling the tube until the ammonia liquefied, calcium-ammonium was formed and dissolved in the excess of liquid ammonia. As more ammonia liquefied, the ammonium chloride became immersed in and dissolved by the liquid. The reddish-brown colour of the calcium-ammonium then rapidly disappeared, hydrogen gas was evolved, and collected in a special apparatus connected with the U-tube. After the evaporation of the ammonia, a compound of calcium chloride and ammonia remained in the U-tube. The volume of the hydrogen obtained showed that at the temperature used ( $-80^{\circ}$ ) ammonium does not exist. Exactly similar results were obtained when lithium was employed instead of calcium. K. J. P. O.

**Ammonium: Action of Hydrogen Sulphide on Metallo-ammonium.** By HENRI MOISSAN (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 490—496; and *Compt. rend.*, 1901, 33, 771—774).—After tracing the history of the searches after ammonium, the author shows that when liquid hydrogen sulphide acts on a known weight of lithium-ammonium or calcium-ammonium at between  $-75^{\circ}$  and  $-70^{\circ}$ , the sulphide of the metal is produced along with free ammonia and hydrogen, according to the equations  $(\text{LiNH}_3)_2 + \text{H}_2\text{S} = \text{Li}_2\text{S} + 2\text{NH}_3 + \text{H}_2$ , and  $\text{Ca}(\text{NH}_3)_4 + 2\text{NH}_3 + \text{H}_2\text{S} = \text{CaS} + 6\text{NH}_3 + \text{H}_2$ . There is therefore no evidence of the existence of ammonium at this low temperature. Ruff's results (*Abstr.*, 1901, ii, 653) have been confirmed. J. McC.

**Solubility of Silver Bromide and Iodide in Water.** By FRIEDRICH KOHLRAUSCH and F. DOLEZALEK (*Sitzungsber. K. Akad. Wiss. Berlin*, 1901, 1018—1023).—The determination of solubility is based on the increase in the conductivity of water shaken up with these compounds (compare Kohlrausch and Rose, *Abstr.*, 1894, ii, 7). It is found that saturated solutions of silver bromide and iodide

(at 21°) contain, respectively, 0.107 mg. and 0.0035 mg. of the salt per litre. These values are smaller than those previously obtained (*loc. cit.*), owing probably to the precautions taken, but agree fairly well with the values based on the potential differences between a silver electrode and the saturated solutions referred to (compare Danneel, *Abstr.*, 1900, ii, 467). J. C. P.

**Silver Subhaloids.** By KOLOMAN EMSZT (*Zeit. anorg. Chem.*, 1901, 28, 346—354).—Vogel claims to have prepared silver subhaloids by the action of cuprous chloride, bromide, and iodide on silver nitrate, and concludes that these are not mixtures of silver and silver haloid. Analysis leads to the formula  $\text{Ag}_4\text{Cl}_2$  for the subchloride; when the substance is treated with nitric acid, however, 2 mols. of silver are dissolved and 2 mols. of silver chloride are left, whilst ammonia or sodium thiosulphate extracts 2 mols. of silver chloride and leaves 2 mols. of silver. On continued shaking with mercury, silver is extracted. By elutriation, the composition is changed.

Light is supposed to produce on the photographic plate a subhaloid of silver which is acted on by the developer. The substances prepared from cuprous salts are themselves acted on by light and are not affected by developers. The author concludes that these supposed subhaloids are merely mixtures of silver and silver haloid produced by the reaction :  $\text{Cu}_2\text{Cl}_2 + 4\text{AgNO}_3 = 2\text{Ag} + 2\text{AgCl} + 2\text{Cu}(\text{NO}_3)_2$ . J. McC.

**The so-called Silver Peroxynitrate.** By SIMEON L. TANATAR (*Zeit. anorg. Chem.*, 1901, 28, 331—336).—The “silver peroxynitrate” was obtained by electrolysing a 25 per cent. solution of silver nitrate between platinum electrodes at 0°, the anode and cathode being separated by a porous cylinder. The substance is deposited at the anode in dark green crystals with a metallic lustre (with 10 dichromate cells, 5 grams can be obtained in an hour). Different preparations had the same composition; the crystals are free from water (Mulder, *Abstr.*, 1896, ii, 561; 1897, ii, 260; Sule, *Abstr.*, 1897, ii, 99) and contain 8.09 per cent. of peroxide oxygen, 79.44 of total silver, and 18.13 of silver nitrate—amounts corresponding with those required for the formula  $\text{Ag}_7\text{NO}_{11}$ . With potassium iodide, the crystals give iodine and potassium iodate.

Electrolysis of other nitrates in neutral and alkaline solutions gives nothing indicating the formation of pernitrates and there is no evidence of the production of pernitrates by the action of hydrogen peroxide on the nitrates of the alkali or alkaline earth metals.

By the electrolysis of silver fluoride, a product is obtained which very closely resembles “silver peroxynitrate.” The product, on being heated, evolves oxygen violently; it contains more peroxide oxygen than silver oxide ( $\text{Ag}_2\text{O}_2$ ). Analysis (8.3 per cent. of peroxide oxygen) leads to the formula  $\text{Ag}_{15}\text{F}_3\text{O}_{16}$ . It is highly improbable that in this compound oxygen is directly united to fluorine, and since the ratio of silver to oxygen is not 1 : 1, it is to be assumed that silver forms another peroxide besides  $\text{Ag}_2\text{O}_2$  and the salt may be a molecular compound,  $4\text{Ag}_3\text{O}_4, 3\text{AgF}$ . Analogously, “silver peroxynitrate” is  $2\text{Ag}_3\text{O}_4, \text{AgNO}_3$ .  $\text{Ag}_{15}\text{F}_3\text{O}_{16}$ , when digested on the water-bath, and washed with hot water gives the compound  $2\text{Ag}_3\text{O}_4, \text{AgF}$  (of the same type as the nitrate) with 8.94 per cent. of peroxide oxygen. J. McC.

**Solubility of Silver Sulphate and Mercurous Sulphate.** By KARL DRUCKER (*Zeit. anorg. Chem.*, 1901, 28, 361—363).—The solubility of these sulphates in water, sulphuric acid, and potassium sulphate solutions at 25° are as follows, the solubility being expressed in grammols. per litre, and  $c$  being the concentration of the acid or salt solution used :

Mercurous sulphate.

	$c$ .	Solubility.
H <sub>2</sub> O.....	—	$11.71 \times 10^{-4}$
$\frac{1}{2}$ H <sub>2</sub> SO <sub>4</sub> .....	0.0400	$8.31 \times 10^{-4}$
$\frac{1}{5}$ H <sub>2</sub> SO <sub>4</sub> .....	0.1000	$8.78 \times 10^{-4}$
$\frac{1}{10}$ H <sub>2</sub> SO <sub>4</sub> .....	0.2000	$8.04 \times 10^{-4}$
$\frac{1}{2}$ K <sub>2</sub> SO <sub>4</sub> .....	0.2000	$9.05 \times 10^{-4}$

Silver sulphate.

H <sub>2</sub> O.....	—	$2.57 \times 10^{-2}$
$\frac{1}{2}$ H <sub>2</sub> SO <sub>4</sub> .....	0.0200	$2.60 \times 10^{-2}$
$\frac{1}{5}$ H <sub>2</sub> SO <sub>4</sub> .....	0.0400	$2.64 \times 10^{-2}$
$\frac{1}{10}$ H <sub>2</sub> SO <sub>4</sub> .....	0.1000	$2.71 \times 10^{-2}$
$\frac{1}{20}$ H <sub>2</sub> SO <sub>4</sub> .....	0.2000	$2.75 \times 10^{-2}$
$\frac{1}{2}$ K <sub>2</sub> SO <sub>4</sub> .....	0.0200	$2.46 \times 10^{-2}$
$\frac{1}{5}$ K <sub>2</sub> SO <sub>4</sub> .....	0.0400	$2.36 \times 10^{-2}$
$\frac{1}{10}$ K <sub>2</sub> SO <sub>4</sub> .....	0.1000	$2.31 \times 10^{-2}$
$\frac{1}{20}$ K <sub>2</sub> SO <sub>4</sub> .....	0.2000	$2.32 \times 10^{-2}$

In the case of silver sulphate, the increase of solubility with increasing concentration for sulphuric acid indicates the existence of a new salt the solubility of which more than compensates for the normal isohydric depression.

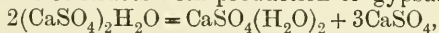
J. McC.

**The Formation of Natural Anhydrite and the Rôle of Time in Chemical Transformations.** By JACOBUS H. VAN'T HOFF [with FREDERICK G. DONNAN, EDWARD F. ARMSTRONG, WILLY HINRICHSSEN, and FRITZ WEIGERT] (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 471—489. Compare Abstr., 1900, ii, 531; 1901, ii, 506).—Gypsum is only very slowly transformed into the hemihydrate or into anhydrite at the transition temperature. The tension of water vapour from gypsum attains the value of one atmosphere with formation of the hemihydrate, (CaSO<sub>4</sub>)<sub>2</sub>.H<sub>2</sub>O, at 101.45°; this point has been found by noting the rise of temperature produced by the addition of common salt to a mixture of gypsum and water, and then by adding water to a mixture of higher boiling point, the temperature remaining constant until, in the first case, the gypsum was completely converted into the hemihydrate, and in the second case until the hemihydrate was completely transformed into gypsum. The transition is greatly accelerated by the presence of solvent liquids; in a tensimeter containing a mixture of precipitated gypsum and the hemihydrate moistened with a solution of magnesium chloride, the tension at 50° became constant at 49.5 mm. after 7 days. At 25°, the tension is 9.1 mm. and 4.99 mm. at 17°. The connection between tension and temperature is given by the equation  $\log p = \log p' + 1.493 - 567.7/(t + 273)$ , where  $p$  is the ten-



sion of gypsum,  $p'$  that of water, both at the temperature  $t$ . When  $p = p'$  (970 mm.),  $t = 107.2^\circ$ ; this would indicate that  $2\text{CaSO}_4(\text{H}_2\text{O})_2 \rightleftharpoons (\text{CaSO}_4)_2, \text{H}_2\text{O} + 3\text{H}_2\text{O}$  takes place at this temperature, and in a dilatometer, containing moist gypsum and using mercury as indicating liquid, a change of volume has been observed at about  $107^\circ$ . In presence of a solution containing 20 per cent. of sodium chloride, gypsum commences to dehydrate at  $93^\circ$ .

For the transformation of gypsum into soluble anhydrite, neither natural nor precipitated gypsum is suitable, but gypsum obtained by treating plaster of paris with much water gave good results. The vapour tension of gypsum in forming anhydrite is higher than that when the hemihydrate is produced:  $\log p = \log p' + 1.41 - 518.8/(t + 273)$ . The transition temperature (at which  $p = p'$ ) corresponding with the reaction  $\text{CaSO}_4(\text{H}_2\text{O})_2 = \text{CaSO}_4 + 2\text{H}_2\text{O}$  is  $95^\circ$ . The hemihydrate is unstable and at  $90^\circ$  it contracts with production of gypsum,



then expands slowly owing to formation of anhydrite,  $\text{CaSO}_4(\text{H}_2\text{O})_2 = \text{CaSO}_4 + 2\text{H}_2\text{O}$ .

The formation of natural anhydrite takes place extremely slowly, but has been observed at  $37^\circ$ . The temperature of formation is depressed by the presence of sodium chloride or other salts, and in this way the natural deposits may be accounted for without assuming a high temperature at the time of formation.

Transitions, such as those referred to above, take place at very different speeds. In the case of salts, double salts, and their hydrates, if the acid is monobasic and the metal monatomic, the transformation is rapid. If the acid is dibasic or the metal diatomic, it is slower (compare supersaturation of sodium sulphate and carbonate, calcium chloride, &c.), and if the acid is dibasic and the metal di- or tri-atomic, hours, or even days, may be required for the change to take place completely (compare the very slow deposition of ferric chloride from its supersaturated solution). In the case of the non-metals, the resistance to transformation increases with the molecular magnitude (ozone and oxygen, plastic and ordinary sulphur, white and red phosphorus, the various modifications of carbon). The idea of "false equilibrium" may be in some measure accounted for by this influence of time on reaction. J. McC.

**Solubility of Gypsum in Aqueous Solutions of Sodium Chloride.** By FRANK K. CAMERON (*J. Physical Chem.*, 1901, 5, 556—576).—The solubility of gypsum is greatly increased by the addition of sodium chloride, thus, at  $26^\circ$ , the solubility per 100 grams of water is 0.2126 gram, but by the addition of 15.2 grams of sodium chloride it is increased to 0.76 gram. Below  $37.5^\circ$ , a maximum of solubility is obtained when the quantity of sodium chloride present is about 135—140 grams per litre; at higher temperatures, the existence of this maximum is doubtful. The transition temperature of the gypsum to the hemihydrate is shown to be dependent on the medium with which it is in contact; in paraffin, change does not occur until about  $145^\circ$ , although in presence of a strong sodium chloride solution it occurs at  $101.45^\circ$ . The rate of dissolution of gypsum in pure water is exceedingly slow, a fact which probably accounts for the diverse numbers which

have been given for its solubility; the author's results are, at  $26^{\circ}$ , about 1 part of gypsum in 372 parts pure water. The theoretical explanation is not fully discussed, but the author considers that the maximum point of the solubility cannot be accounted for by our present hypotheses regarding solutions.

L. M. J.

**Density and Expansion by Heat of Solutions of Magnesium Chloride.** By GUSTAV J. W. BREMER (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 455—470).—The densities of solutions of magnesium chloride of different concentrations have been determined at various temperatures; for the solutions examined, the density at any particular temperature can be ascertained by means of the formula  $d_t = d_0 (1 - at - bt^2)$ , the values of  $d_0$ ,  $a$ , and  $b$  being:

Grams of magnesium chloride per 100 c.c. of solution.	$d_0$ .	$a$ .	$b$ .
20.0004	1.160503	$2.2738 \times 10^{-4}$	$1.3443 \times 10^{-6}$
13.3111	1.11055	$2.0072 \times 10^{-4}$	$1.7534 \times 10^{-6}$
9.9506	1.08451	$1.8587 \times 10^{-4}$	$2.0482 \times 10^{-6}$
6.7158	1.059117	$1.7208 \times 10^{-4}$	$2.2884 \times 10^{-6}$

The density at  $0^{\circ}$ ,  $d_0$ , expressed as a function of the weight of magnesium chloride,  $p$ , in 100 c.c. of solution, is  $d_0 = 1 + (9.1729 \times 10^{-3} \times p) - (5.507 \times 10^{-5} \times p^2)$ . The coefficient of expansion,  $a$ , increases with the concentration, whilst  $b$  diminishes, which indicates that the expansion is the more regular the higher the concentration. The curves representing the expansion of the four solutions intersect near  $60^{\circ}$ .

J. McC.

**Formation of Tachyhydrite.** By JACOBUS H. VAN'T HOFF, F. B. KENRICK, and HARRY M. DAWSON (*Zeit. physikal. Chem.*, 1901, 39, 27—63).—The solubility relations of magnesium chloride and calcium chloride were investigated and the saturation fields obtained for the compounds  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ ;  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ ;  $\text{CaCl}_2 \cdot 4\text{H}_2\text{O}$ , and tachyhydrite. Equilibrium between tachyhydrite and the two hexachlorides occurs at  $22.39^{\circ}$ , at which temperature the double salt is first deposited; at  $29.4^{\circ}$ , the hexahydrate of calcium chloride passes into the tetrahydrate, but the temperature is lowered by the addition of magnesium chloride, so that the equilibrium temperature of  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ ;  $\text{CaCl}_2 \cdot 4\text{H}_2\text{O}$ , and tachyhydrite is only  $25^{\circ}$ . A diagram is given representing the solubilities between  $16.7^{\circ}$  and  $32^{\circ}$ . Increase of pressure causes a rise of temperature of formation of tachyhydrite and by direct determination with a manocryometer the temperature coefficient was found to be  $+0.0162^{\circ}$  per atmosphere. The value may be calculated by the expression  $dT/dP = 1033.3T(v_2 - v_1)/42500r$ , where  $v_2$  and  $v_1$  are respectively the specific volumes of the tachyhydrite with its saturated solution and the equivalent simple hydrates, and  $r$  is the thermal value of the change. Direct determination led to  $v_2 - v_1 = 0.06342$  c.c.; the densities were found to be,  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O} = 1.5907$ ;  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O} = 1.7182$ ; tachyhydrite = 1.6655, saturated solution 1.4477, and hence  $v_2 - v_1 = 0.06323$  c.c. The value of  $r$ , obtained indirectly from the

heats of solution of the various compounds, is 33·82 cal., and from these numbers, the result  $dT/dP = 0\cdot0135^\circ$  per atmosphere is obtained, a value which agrees well with the direct determinations (see Abstr., 1900, ii, 12).

L. M. J.

**Hydroxides of Zinc and Lead.** By W. HERZ (*Zeit. anorg. Chem.*, 1901, 28, 474–476).—Zinc hydroxide, precipitated from a solution of zinc sulphate by dilute potassium hydroxide, readily dissolves in excess of potassium hydroxide and is completely dissolved when for 1 Zn there are 6 OH groups. If, however, the zinc hydroxide is previously dried at 60–70° in a vacuum desiccator, it becomes comparatively difficult to dissolve, and is completely dissolved when for 1 Zn there are 35·8 OH groups in the solution. Lead hydroxide, on the other hand, is not altered in solubility by drying at 60–70°. It is completely dissolved when for 1 Pb there are 8·5 to 8·8 OH groups in the solution.

E. C. R.

**Action of Water on Lead.** By STANISLAV RŮŽIČKA (*Arch. Hygiene*, 1901, 41, 23–45).—The action of water and solutions of salts on bright metallic lead was examined by placing the lead in cylinders containing the various liquids, inserting the stopper so that the cylinder contained no air, leaving the whole for 24 hours, and then estimating the amount of lead contained in the liquid. The nitrates, chlorides, sulphates, and carbonates of potassium, sodium, calcium, magnesium, and ammonium were employed, and it was found that the influence of these salts is independent of the base and that whilst nitrates increase the action of the water, or in certain concentrations leave it unaltered, chlorides, sulphates, and carbonates diminish the action, the effect increasing in the order named. When the different salts are present together, they preserve this mode of action. Thus the addition of a nitrate increases the action of solutions of chlorides, sulphates, or carbonates; the addition of a carbonate diminishes the action of solutions of nitrates, chlorides, or sulphates; the addition of a sulphate diminishes the action of solutions of nitrates or chlorides, but has no effect on those of carbonates; finally, the addition of a chloride diminishes the action of solutions of sulphates and nitrates, and either increases or leaves unaltered those of carbonates. When the same piece of lead is exposed to the action of fresh solutions containing carbonate, the amount of lead taken up diminishes very greatly and the surface of the lead becomes covered with a thin film which cannot easily be removed by rubbing.

The same diminution occurs even in the presence of nitrates and free oxygen, provided that the carbonate be present in sufficient proportion (more than half the equivalent of the nitrate). Free carbon dioxide also greatly diminishes the action of water and salt solutions on lead, both when present as a saturated solution at the commencement of the experiment, and when a current of the gas is passed through the liquid throughout the experiment. The presence of air in all cases greatly increases the solvent action.

The action of various organic substances was also examined, and it was found that infusions of grass leaves and of radish leaves diminished the action of water, whilst infusion of peat greatly increased it.

The action of the salts is ascribed to the varying solubility of the lead salts of the corresponding acids, the nitrate being the most soluble and the sulphate and carbonate the least. A. H.

**Radioactive Substances.** By FRITZ GIESEL (*Ber.*, 1901, 34, 3772—3776. Compare Abstr., 1901, ii, 99).—The assumption that radioactive lead contains a new active element is scarcely justifiable unless it can be shown that this material possesses properties differing from those of the known radioactive elements (compare Abstr., 1901, ii, 19, 159, 216, and 655).

The activity of radioactive lead sulphate, indicated either by its effect on the electroscope or by its photographic action, is not diminished on keeping, neither is it increased by the action of the cathode rays. The photographic action of the sulphate is also exhibited by the carbonate, chloride, and sulphide. The author has noticed the phosphorescence of radioactive lead sulphate, but the action is so slight that an experienced eye is required to detect it.

A sample of radioactive lead sulphate, wrapped in black paper and laid on the glass of a photographic plate, did not produce any effect even after fifteen hours; an impression was obtained, however, when the specimen was enclosed in transparent paper. This result is obtained with the sulphate and not with the corresponding chloride or sulphide.

A feebly active radium preparation enclosed in black paper affects a photographic plate when placed directly on the film; the radioactive lead sulphate enveloped in tracing paper produces an appreciable effect, even through the glass of the plate. In the former case, the Becquerel rays are operative, whilst in the latter the action is due to light rays. An artificial mixture of inactive lead and radium, containing so little of the latter substance that its presence cannot be detected by chemical means, is nevertheless distinctly radioactive, this property being noticeable in the lead sulphide and also in the iodide prepared from it.

The new product obtained by the author from the radium mother liquors (Abstr., 1901, ii, 99) resembles actinium and radium in retaining its radioactivity for a year. Polonium preparations, when preserved for a similar period, exhibit a marked diminution of activity.

The rare earths of the cerium group, containing cerium, lanthanum, and didymium as the chief constituents, give photographic impressions after 5 hours' exposure. The precipitate obtained from a thorium nitrate solution by the action of hydrogen peroxide is also strongly radioactive. In all these cases, the activity, however, rapidly diminishes, this result indicating the absence of actinium.

The water distilled off from crystallised radium-barium chloride is strongly radioactive, at first even more so than the residual chloride. That this activity is not due to any radium which might have been mechanically carried over into the distillate is shown from the fact that the action diminishes in the course of a few days. G. T. M.

**Radioactive Substances.** By KARL A. HOFMANN and EDUARD STRAUSS (*Ber.*, 1901, 34, 3970—3973. Compare Abstr., 1901, ii, 655).—A reply to Giesel (preceding abstract). Further experiments are



described which tend to prove that the radioactive lead sulphate is free from radium, actinium, and polonium. J. J. S.

**Action of Carbon Dioxide and Alkali Salts on Metallic Oxides and the Relative Strength of Hydrochloric and Nitric Acids.** By OTTO KÜHLING (*Ber.*, 1901, 34, 3941—3945. See Abstr., 1901, ii, 656).—From a consideration of the previous experiments (*loc. cit.*), it would appear that nitric acid is a stronger acid than hydrochloric acid. Experiments are now described in which the copper oxide is replaced by mercuric oxide and lead oxide. Mercuric oxide, in the presence of sodium chloride and carbon dioxide, is slowly converted into the oxychloride,  $2\text{HgCl}_2 \cdot \text{HgO}$ , but, if the sodium chloride is replaced by sodium nitrate, the oxide is not attacked. Similar results, although not so definite, were obtained with lead oxide. R. H. P.

**Identity of the Red and Yellow Oxides of Mercury.** By J. KOSTER and S. J. STORK (*Rec. Trav. Chim.*, 1901, [ii], 20, 394—397).—When the red oxide is finely powdered for 2 hours in an agate mortar, it is almost as easily acted on by aqueous oxalic acid as the yellow oxide, although the different action of this acid on the two oxides has hitherto been used as a pharmaceutical distinction. Obviously, as maintained by Ostwald (*Zeit. physikal. Chem.*, 1895, 18, 159; Abstr., 1900, ii, 712), the oxides are identical and not isomeric (compare Cohen, Abstr., 1900, ii, 184, 381). W. A. D.

**Thallium Chlorobromides of the Type  $\text{Tl}_4\text{X}_6$ .** By VICTOR THOMAS (*Compt. rend.*, 1901, 133, 735—737. Compare Abstr., 1901, ii, 159).—Cushman (Abstr., 1900, ii, 725) obtained two isomeric compounds of the formula  $\text{Tl}_4\text{Cl}_3\text{Br}_3$ , crystallising in characteristically different forms (orange plates and blood-red crystals). The author finds that the chlorobromide,  $\text{Tl}_4\text{Cl}_3\text{Br}_3$  (*loc. cit.*), crystallises usually in a mixture of needles and plates, which appear to belong to the same crystalline system. The one form readily passes into the other. Both forms, when heated alone or in presence of the solution from which they have been deposited, become blood-red; on cooling, they regain their original orange colour. K. J. P. O.

**Place of the Rare Earth Metals among the Elements.** By BERTRAM D. STEELE (*Chem. News*, 1901, 84, 245—247).—Arguments are advanced in favour of regarding the rare earth metals as an inter-periodic group between groups IV and V of a modified periodic system with seven elements each in groups I and II, and seventeen elements in each of the groups III and IV. D. A. L.

**Metals of the Cerium Group.** By THEODOR H. BEHRENS (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 67—91).—The metals of this group, lanthanum, cerium, praseodymium, neodymium, and samarium, can be separated from the metals accompanying them in minerals by precipitation as formates in slightly acid solution. If the quantity of cerium metals is small, the other metals should first be removed,

thorium as oxalate, metals of the yttrium group by precipitation with sodium sulphate, ammonium carbonate or ammonium lactate, and zirconium as lactate.

The formates of the metals of the cerium group are sparingly soluble and crystallise in the pentagonal dodecahedron form. Lanthanum and praseodymium formates are the least soluble and consequently can be separated by addition of formic acid in insufficient quantity.

The acetates are easily soluble and difficult to obtain crystallised. On boiling the solutions, basic acetates are formed. Basic lanthanum acetate with iodine turns red, then violet, and finally blue.

The oxalates are precipitated as monoclinic crystals sparingly soluble in water, but easily so in concentrated hydrochloric acid or nitric acid.

Ammonium succinate precipitates the metals of the cerium group either in spheroidal aggregates or prismatic crystals depending on the substances present in the solution. Solutions in which cerium and praseodymium nitrates predominate give flocculent masses which appear bluish in reflected light, neodymium and thorium nitrates give smooth, brown plates and spheroids. Prismatic crystals are precipitated from solutions containing much lanthanum nitrate; the crystals show brilliant polarisation colours of the second and even of the third order, and the lanthanum succinate can always be recognised amongst the other succinates. After being warmed with ammonia, cerium succinate, when moistened with hydrogen peroxide, turns brown, and can thus be distinguished from the other succinates, which remain colourless.

The metals of the cerium group can also be distinguished by conversion into benzoates or salicylates.

It is possible to obtain cerium pure by repeated crystallisation of the ammonium double nitrates; pure neodymium can only be prepared in this way with the aid of some precipitant, and on account of the isomorphous nature of the double nitrates it is not possible to separate pure praseodymium. No separation of lanthanum and praseodymium can be attained by crystallisation of the acetates.

A pure solution of lanthanum can be obtained by extracting the mixed "cerite" oxide with nitric acid of sp. gr. 1.2 for 10 minutes; even better results are obtained with dilute sulphuric acid.

When cerium is precipitated with an oxidising agent (sodium hypochlorite, hydrogen peroxide, potassium permanganate) in presence of sodium acetate, lanthanum is constantly carried down with it, and if persulphuric acid is used, the cerium precipitate is further contaminated with double sulphates of calcium and the metals of the cerium group.

By the addition of ammonia, samarium is first precipitated, then neodymium, praseodymium, and lanthanum, but no satisfactory separation can be made on this basis. Cerium nitrate, when boiled with much water, is precipitated as basic nitrate, but the precipitate constantly contains very appreciable quantities of lanthanum, samarium, and neodymium. In the same way, basic cerium sulphate can be obtained, and if care be taken that some free sulphuric acid is present, so that the cerium is not completely removed in the precipitate, an almost pure cerium salt is obtained.

Mosander's method of separating lanthanum, neodymium, and praseodymium as normal sulphates does not lead to pure products, neither does Delafontaine's modification in which the solution is shaken with alcohol.

The author does not regard it as yet possible to give a satisfactory method of separating the metals of this group in a pure form.

J. McC.

**Mechanism of Action of Hydrogen Peroxide on Permanganic Acid.** By A. БАЧН (*Ber.*, 1901, 34, 3851—3855).—Traube has suggested that the reduction of permanganic acid by hydrogen peroxide is due to the readiness with which the hydrogen of the peroxide is oxidised; Berthelot, on the other hand, has suggested that the peroxide first becomes oxidised to the higher oxide,  $H_2O_3$ , which then decomposes into water and oxygen. In order to test these views, the behaviour of ethyl hydrogen peroxide towards permanganic acid and of 'Caro's acid' towards permanganic oxide were studied; it is suggested that on Traube's hypothesis these compounds should only reduce half as much oxygen as the equivalent of hydrogen peroxide, whilst on Berthelot's hypothesis the reducing power should be the same. Actually, the ethyl hydrogen peroxide behaves exactly like hydrogen peroxide, whilst Caro's acid shows a somewhat lower reducing power, and this is regarded as affording support to Berthelot's hypothesis.

T. M. L.

**Passive Iron.** By ALEXIS FINKELSTEIN (*Zeit. physikal. Chem.*, 1901, 39, 91—110).—Determinations of the polarisation capacity and resistance of passive iron indicate that it cannot be covered by a coating of badly conducting oxide, and the numbers are very nearly equal to those obtained for platinum. Passive iron does not behave as an iron electrode, but as an oxygen electrode of variable oxygen concentration. The *E.M.F.* of iron electrodes against various solutions were determined; addition of potassium cyanide to the solutions greatly lowers the *E.M.F.*, and in solutions of mixed ferrous and ferric salts the *E.M.F.* decreases as the ferrous salt becomes replaced by ferric. The polarisation curves were investigated, and the non-existence of an oxide layer again indicated. The author discusses the cause of the passivity, and shows that it may be accounted for by the assumption that the surface of passive iron consists solely of tervalent iron, the formation of passive iron by oxidising agents and electrolysis being due to the replacement of the bivalent by tervalent iron. L. M. J.

**Isomerism in the Cobalt-tetrammine Series.** By KARL A. HOFMANN and A. JENNY (*Ber.*, 1901, 34, 3855—3873).—Two isomeric disulphitotetramminecobalt salts,  $Co(NH_3)_4(SO_3)_2NH_4 \cdot 3H_2O$  and  $Co(NH_3)_4(SO_3)_2NH_4 \cdot 4H_2O$ ,

result from the action of sulphurous acid on the carbonatotetrammine chloride, or on a solution, oxidised by exposure to air, of ammoniacal cobalt acetate. The first of these has already been described (Hofmann and Reinsch, *Abstr.*, 1898, ii, 377), but it has since been found that all the water can be driven off without destroying the compound, and its formula must therefore be written in the form given above.

It forms brown, birefringent prisms belonging to the monoclinic system [ $a:b:c = 0.859:1:0.534$ ;  $\beta = 111^\circ 23'$ ]; it affords no coloration with ammoniacal sodium nitroprusside, and no precipitate with mercurous nitrate, but slowly gives a flocculent precipitate with thallium nitrate; in aqueous solution, it has half the normal mol. weight and is regarded as dissociating into the ions  $\text{NH}_4$  and  $\text{Co}(\text{NH}_3)_4(\text{SO}_3)_2$ . When dissolved in sulphuric acid, hydrochloric acid precipitates the praseo-chloride,  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}, \text{H}_2\text{O}$ .

The second salt crystallises from water in reddish-yellow prisms which are fairly stable in air but rapidly effloresce in a vacuum; like the preceding salt, it is readily converted into the praseo-chloride, and behaves in a similar manner with thallium nitrate, mercurous nitrate, and ammoniacal nitroprusside.

These two isomeric salts cannot be regarded as merely polymorphous forms of one salt, as they give different colour reactions with sulphuric acid and are not converted into one another by recrystallisation.

The two corresponding sodium salts usually crystallise with  $2\text{H}_2\text{O}$  and  $4\text{H}_2\text{O}$  respectively. The first salt is brown in colour and has already been described (Hofmann and Reinsch, *loc. cit.*; Werner and Gröger, Abstr., 1898, ii, 379); it forms square tablets, probably belonging to the monoclinic system, and is precipitated unchanged from a concentrated aqueous solution on adding alcohol, but separates from a dilute solution in reddish-brown, orthorhombic needles with  $3\text{H}_2\text{O}$ ; in aqueous solution, it shows half the normal mol. weight.

The isomeric sodium salt forms golden-yellow needles of the formula  $\text{Co}(\text{NH}_3)_4(\text{SO}_3)_2\text{Na}, 4\text{H}_2\text{O}$ , readily effloresces, and loses all its water in a vacuum.

The salt  $\text{Co}_2(\text{NH}_3)_4(\text{SO}_3)_3, 6\text{H}_2\text{O}$  is prepared from a bye-product obtained in making the ammonium salts described above; it forms birefringent prisms, and is completely dehydrated at  $85^\circ$ ; when dissolved in sulphuric acid and mixed with hydrochloric acid, it gives chloropentamminocobalt chloride (purpureo-chloride),  $\text{CoCl}(\text{NH}_3)_5\text{Cl}_2$ , and is therefore regarded as a double salt of a pentammine sulphite with a triammine sulphite.

Complex salts of the formulæ  $\text{Co}_3(\text{NH}_3)_8(\text{SO}_3)_6\text{Na}_3, 6\text{H}_2\text{O}$  and  $\text{Co}_3(\text{NH}_3)_6(\text{SO}_3)_6\text{Na}_2, 6\text{H}_2\text{O}$  are described.

The acid sulphite,  $\text{Co}(\text{NH}_3)_4(\text{CO}_3) \cdot \text{SO}_3\text{H}$ , forms violet-red crystals, and is shown to be a true tetrammine by its conversion into the praseo-chloride.

Three sulphito-compounds containing 3 mols. of  $\text{NH}_3$  are described: a dark-brown salt,  $\text{Co}_2(\text{NH}_3)_6(\text{SO}_3)_3, 3\text{H}_2\text{O}$ , crystallising in prisms; a dark-brown salt,  $\text{Co}(\text{NH}_3)_3(\text{SO}_3)_2\text{H}, 2\text{H}_2\text{O}$ , crystallising in hexagonal tablets, and a dark-brown sodium salt,  $\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})(\text{SO}_3)_2\text{Na}, 2\text{H}_2\text{O}$ , which will only part with  $2\text{H}_2\text{O}$  without decomposition. T. M. L.

**Some Allotropic Modifications of Inorganic Compounds.** By W. HERZ (*Zeit. anorg. Chem.*, 1901, 28, 342—345. Compare Abstr., 1900, ii, 728; 1901, ii, 513).—Nickel sulphide, precipitated with ammonium sulphide, shows the same phenomena as cobalt sulphide. The nickel sulphide, exposed to the air, oxidises very readily to sulphate.



Chromium hydroxide, precipitated by alkali, is easily soluble in excess of the reagent; after being dried in a vacuum, however, the hydroxide is insoluble in alkalis. In these cases, the less stable form is first produced and gradually changes to the more stable form.

Zinc oxide heated to  $250^{\circ}$  shows a faint yellow colour and if the yellow (hot) and the white (cold) oxide were allotropic forms it would be expected that on prolonged heating at this temperature the change to the yellow modification would be complete. The intensity of the colour does not, however, increase, indicating that there is no transition and that the two forms cannot be considered as allotropic modifications.

J. McC.

**Chromium Halogen Compounds with Alcohol.** By IWAN KOPPEL (*Zeit. anorg. Chem.*, 1901, 28, 461—473).—The salt  $\text{CrCl}_3 \cdot 3\text{EtOH}$  is obtained by treating metallic chromium with a concentrated solution of dry hydrogen chloride in absolute alcohol. It crystallises in deep red needles, is fairly stable in dry air, in damp air is quickly converted into green chromium trichloride hexahydrate, and when heated yields alcohol and ethyl chloride. It dissolves in water to a red solution which quickly turns green, the same colour phenomenon taking place more slowly in alcohol, chloroform, or acetone solution. An examination of the electrical conductivity of the solution in absolute alcohol shows that this colour change is due to causes similar to that observed by Werner and Gubser (*Abstr.*, 1901, ii, 453) in the case of the green chromium chloride, the change of colour from red into green being accompanied by an increase in the electrical conductivity. This salt is also obtained by heating the violet chromium chloride with absolute alcohol and a stick of metallic zinc.

The corresponding chromium bromide salt, obtained in a similar manner, crystallises in dark reddish-brown crystals which give brown solutions that quickly turn green. It was not, however, obtained in a pure state.

E. C. R.

**Silicomolybdates.** By WLADISLAW ASCH (*Zeit. anorg. Chem.*, 1901, 28, 273—313).—Molybdic acid, when added to a boiling solution of sodium silicate ( $\text{Na}_2\text{SiO}_3 \cdot 9\text{H}_2\text{O}$ ) dissolves readily at first and some gelatinous silicic acid is separated. By further addition of molybdic acid to the saturation point, the silicic acid redissolves and the solution (which becomes intensely yellow) when evaporated at  $45^{\circ}$  deposits yellow crystals of sodium silicomolybdate,  $2\text{Na}_2\text{O} \cdot \text{SiO}_2 \cdot 12\text{MoO}_3 \cdot 21\text{H}_2\text{O}$ . This salt is dimorphous. Attempts to obtain any other sodium silicomolybdate proved futile. Solutions of sodium silicomolybdate with solutions of salts of potassium, ammonium, rubidium, caesium, thallium, barium, strontium, calcium, nickel, cobalt, cadmium, aniline, pyridine, and quinoline give corresponding silicomolybdates. Of these, only the following have been analysed:  $2\text{K}_2\text{O} \cdot \text{SiO}_2 \cdot 12\text{MoO}_3 \cdot 16\text{H}_2\text{O}$ ;  $2\text{MgO} \cdot \text{SiO}_2 \cdot 12\text{MoO}_3 \cdot 30\text{H}_2\text{O}$ ;  $2\text{BaO} \cdot \text{SiO}_2 \cdot 12\text{MoO}_3 \cdot 24\text{H}_2\text{O}$ , and  $2\text{CaO} \cdot \text{SiO}_2 \cdot 12\text{MoO}_3 \cdot 24\text{H}_2\text{O}$ . With a dilute solution of silver nitrate, sodium silicomolybdate gives a small quantity of ruby crystals and a yellow salt having the composition  $2\text{Ag}_2\text{O} \cdot \text{SiO}_2 \cdot 12\text{MoO}_3 \cdot 12\text{H}_2\text{O}$ .

With concentrated silver nitrate, a yellow precipitate of  $4\text{Ag}_2\text{O}, \text{SiO}_2, 12\text{MoO}_3, 15\text{H}_2\text{O}$  is obtained.

By treating the sodium or potassium salt (1 mol.) with hydrochloric acid (4 to 8 mols.) compounds of the formula  $1\frac{1}{2}\text{Na}_2\text{O}, \text{SiO}_2, 12\text{MoO}_3, 17\text{H}_2\text{O}$  and  $1\frac{1}{2}\text{K}_2\text{O}, \text{SiO}_2, 12\text{MoO}_3, 14\text{H}_2\text{O}$  are formed, and these salts can also be prepared by adding the calculated quantity of alkali to the free acid. This potassium salt gives, with silver nitrate, yellow crystals of  $1\frac{1}{2}\text{Ag}_2\text{O}, \text{SiO}_2, 12\text{MoO}_3, 11\text{H}_2\text{O}$ , as well as ruby crystals which have not been analysed. With alkali or sodium carbonate, sodium silicomolybdate (with  $1\frac{1}{2}\text{Na}_2\text{O}$ ) gives only sodium trimolybdate. Silicomolybdic acid,  $\text{SiO}_2, 12\text{MoO}_3, 32\text{H}_2\text{O}$  (or  $2\text{H}_2\text{O}, \text{SiO}_2, 12\text{MoO}_3, 30\text{H}_2\text{O}$ ), was obtained by decomposing the sodium salt with dilute sulphuric acid and extracting with ether.

By dialysing a 5 per cent. solution of the salt  $2\text{K}_2\text{O}, \text{SiO}_2, 12\text{MoO}_3, 16\text{H}_2\text{O}$  it was found that the ratio of  $\text{K}_2\text{O} : \text{SiO}_2 : \text{MoO}_3$  was the same in the diffused solution as in the original, indicating that the silicic and molybdic acids form a complex ion. The conductivities and densities of solutions of the acid and of the potassium salt have been determined at  $10^\circ$ ,  $20^\circ$ ,  $30^\circ$ , and  $40^\circ$ . The results indicate that the silicomolybdates are fairly stable and only suffer decomposition at high dilution, and that this decomposition is increased by rise of temperature.

By measuring the depression of the freezing point of Glauber's salt (Löwenherz, Abstr., 1896, ii, 149), caused by the addition of the sodium salt, it was found that the mol. weight corresponds with that required for the formula  $\text{Na}_4\text{SiMo}_{12}\text{O}_{40}$ . The salts  $2\text{R}_2\text{O}, \text{SiO}_2, 12\text{MoO}_3, \text{aq}$  are to be regarded as normal salts of tetrabasic silicomolybdic acid, whilst the salts  $1\frac{1}{2}\text{R}_2\text{O}, \text{SiO}_2, 12\text{MoO}_3, \text{aq}$  are acid salts of the same acid ( $\frac{1}{2}\text{R}_2\text{O}$  being replaced by  $\frac{1}{2}\text{H}_2\text{O}$ ).

At  $100^\circ$ ,  $2\text{Na}_2\text{O}, \text{SiO}_2, 12\text{MoO}_3, 21\text{H}_2\text{O}$  loses  $17\frac{1}{2}$  mols. of water, and  $1\frac{1}{2}\text{Na}_2\text{O}, \text{SiO}_2, 12\text{MoO}_3, 17\text{H}_2\text{O}$  loses 13 mols.; that is, the normal salt has  $3\frac{1}{2}$  mols. of water of constitution and the acid salt has 4.

In the analysis of the compounds the silica was determined after removing the molybdic acid by heating to a high temperature in a current of hydrogen chloride. J. McC.

**Uranous Sulphate.** By WILLIAM OECHSNER DE CONINCK (*Bull. Acad. Roy. Belg.*, 1901, 483—485).—The sp. gr. of aqueous solutions of uranous sulphate as well as of solutions in sulphuric acid and hydrochloric acid have been determined. A 1 per cent. solution in water has a sp. gr. 1.0058, a 10 per cent. solution 1.0539. A 1 per cent. solution in sulphuric acid of sp. gr. 1.14 has a sp. gr. 1.1442, a 5 per cent. solution 1.1626. In solution in hydrochloric acid of sp. gr. 1.046, a 1 per cent. solution has a sp. gr. 1.0525, a 5 per cent. solution 1.0744. Water acts on uranous sulphate, producing a basic salt and a substance of the formula  $2\text{USO}_4, 3\text{UO}, 4\text{H}_2\text{O}$ , has been isolated.

J. McC.

**Tin-Aluminium Alloys.** By LÉON GUILLET (*Compt. rend.*, 1901, 133, 935—937).—The action of stannic oxide on aluminium is very energetic, but the limit of inflammation is reached with a mixture corresponding with  $\text{Al}_4\text{Sn}$ . The product from this mixture, when

treated with dilute hydrochloric acid, yields lamellar and filiform crystals of the compound  $\text{Al}_4\text{Sn}$ . Similarly, mixtures corresponding with  $\text{Sn}_4\text{Al}$ ,  $\text{SnAl}$ , and  $\text{SnAl}_2$  yield lamellar and filiform crystals of the compound  $\text{AlSn}$ .  
C. H. B.

**New Element associated with Thorium.** By CHARLES BASKERVILLE (*J. Amer. Chem. Soc.*, 1901, 23, 761—774. Compare Brauner, *Proc.*, 1901, 17, 67).—Freshly precipitated thorium hydroxide was dissolved in hydrochloric acid; the solution was neutralised with ammonia and saturated with sulphur dioxide. A basic sulphite separated, and on addition of ammonia to the filtrate a further precipitate was obtained. Each of these precipitates was carefully ignited; the resulting oxides had the sp. gr. 9·38 and 10·367 respectively.

On heating a solution of thorium hydroxide in saturated citric acid solution, a white, amorphous precipitate of the hydrated citrate of real thorium was obtained, which yielded specimens of the oxide of sp. gr. varying from 9·188 to 9·253, whilst the citrate obtained by concentrating the filtrate furnished an oxide of sp. gr. 10·50. After the removal of the insoluble citrate from a large quantity of the saturated citrate solution, the filtrate slowly deposited a small quantity of heavy crystals which, on ignition, yielded 31·61 per cent. of oxide of sp. gr. 8·47—8·77; the author suggests this may be the oxide of the new metal discovered by Hofmann and Prandtl (*Abstr.*, 1901, ii, 387) in euxenite; on evaporation of the filtrate, several fractions of the crystalline citrate were obtained, the oxide from which had a sp. gr. 10·14—11·26.

The radioactivity of the oxide (sp. gr. 9·25) obtained from the insoluble citrate is very slight, whilst the oxides of high specific gravity are quite active, the activity increasing with the sp. gr.

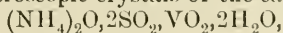
These experiments indicate the presence of a new element, the oxide of which has a high sp. gr.; its atomic weight (calculated for a quadrivalent element) appears to lie between 260 and 280. The author proposes for this metal the name *carolinium*.

The atomic weight of thorium, obtained by analysis of the tetrachloride, was found as the mean of two experiments to be 222—223·3.

E. G.

**Sulphites and Sulphates of Quadrivalent Vanadium.** By IWAN KOPPEL and E. C. BEHRENDT (*Ber.*, 1901, 34, 3929—3936).—Vanadyl sulphite forms two series of double salts with the sulphites of the alkalis, the salts of one series being blue, and having the empirical formula  $\text{R}'_2\text{O}, 2\text{SO}_2, 3\text{VO}_2, \text{aq}$ , those of the other being green, with the formula  $\text{R}'_2\text{O}, 2\text{SO}_2, \text{VO}_2, \text{aq}$ .

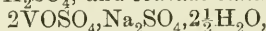
The salt,  $(\text{NH}_4)_2\text{O}, 2\text{SO}_2, 3\text{VO}_2, \text{H}_2\text{O}$ , obtained when a solution of ammonium metavanadate (1 mol.) and ammonia (1 mol.) is saturated with sulphur dioxide and evaporated in the presence of the same gas, crystallises in long, blue, rectangular tablets, which are quite stable in air. When a saturated solution of ammonium metavanadate is mixed with a large excess of a neutral solution of ammonium sulphite and evaporated, green, microscopic crystals of the salt,



are obtained.

The corresponding potassium and sodium salts are obtained by analogous methods. The blue *potassium* salt crystallises in microscopic tablets, which dissolve in water without decomposition; the green *potassium* salt crystallises, with  $5\frac{1}{2}\text{H}_2\text{O}$ , from water in rectangular tablets, and is stable in air. The blue *sodium* salt was obtained in long, prismatic crystals with  $4\text{H}_2\text{O}$ , and the green *sodium* salt with  $5\text{H}_2\text{O}$  as a microcrystalline powder, both, however, decomposing when kept in air.

When barium metavanadate suspended in water is reduced with sulphur dioxide, a solution is obtained which, when evaporated in the presence of sulphur dioxide, deposits a dark brown, microcrystalline powder having the composition  $3\text{VO}_2, 2\text{SO}_2, 4\frac{1}{2}\text{H}_2\text{O}$ ; this may be either vanadyl sulphite or vanadyl sulphurous acid. Double sulphates of the alkalis and vanadyl can be obtained by crystallisation of the mixed sulphates at  $100^\circ$  or above from solutions containing sulphuric acid. *Ammonium vanadyl sulphate*,  $2\text{VOSO}_4, (\text{NH}_4)_2\text{SO}_4, \text{H}_2\text{O}$ , *potassium vanadyl sulphate*,  $2\text{VOSO}_4, \text{K}_2\text{SO}_4$ , and *sodium vanadyl sulphate*,



were obtained as extremely hygroscopic, microcrystalline tablets. An *ammonium vanadyl sulphate* of the composition  $(\text{NH}_4)_2\text{SO}_4, \text{VOSO}_4, 3\frac{1}{2}\text{H}_2\text{O}$ , was also prepared. R. H. P.

**Compounds of Gold and Chlorine.** By FERNAND MEYER (*Compt. rend.*, 1901, 133, 815—818).—If gold is treated with liquid chlorine in a sealed tube at the ordinary temperature, the metal is superficially attacked and converted into a crystalline, red mass. When the tubes containing the gold and chlorine are heated intermittently at  $100^\circ$ , the gold entirely dissolves, forming a deep yellow solution, and, on cooling, auric chloride separates in wine-red, very hygroscopic crystals.

The dissociation of auric chloride has been studied in a specially constructed apparatus. At  $150^\circ$ , the dissociation becomes marked, and a greyish-green solid (a mixture of aurous chloride and gold) and chlorine are formed. The dissociation pressure was measured up to  $205^\circ$ , when the system ceases to have only one variable, as the auric chloride begins to volatilise. If at a given temperature,  $t$ , the chlorine (which was at a given pressure,  $p$ ) was slowly removed from the apparatus, until all the auric chloride had disappeared, the pressure assumed a new value,  $p'$ , which remained constant until only gold was left in the tube. Auric chloride, therefore, dissociates into aurous chloride and chlorine. Aurous chloride is sensibly dissociated at  $170^\circ$ ; the dissociation pressure was measured up to  $240^\circ$ . These experiments show that there is only one compound of gold and chlorine, namely, aurous chloride, containing less chlorine than auric chloride.

K. J. P. O.

**Ruthenium. IV. The Chlorides.** By JAS. LEWIS HOWE (*J. Amer. Chem. Soc.*, 1901, 23, 775—788).—*Cæsium* and *rubidium ruthenichlorides*,  $\text{Cs}_2\text{RuCl}_6$  and  $\text{Rb}_2\text{RuCl}_6$ , crystallise in black, almost opaque, regular octahedra and are slightly soluble in water. The *oxyruthenichlorides*,  $\text{Cs}_2\text{RuO}_2\text{Cl}_4$  and  $\text{Rb}_2\text{RuO}_2\text{Cl}_4$ , form dark purple, cubic crystals, and are instantly decomposed by water with production of a black precipitate. *Cæsium* and *rubidium chlorides* unite with



ruthenium trichloride to form the *double* salts,  $\text{Cs}_2\text{RuCl}_5\cdot\text{H}_2\text{O}$  and  $\text{Rb}_2\text{RuCl}_5\cdot\text{H}_2\text{O}$ , which are dark brown powders fairly soluble in water.

When a slightly acid solution of caesium ruthenichloride is heated with water and alcohol, a rose-coloured *salt*,  $2\text{CsCl}\cdot\text{Ru}(\text{OH})_2\text{Cl}_3$ , is produced, which crystallises in prisms and is very slightly soluble in water. By electrolytic reduction of ruthenium trichloride and addition of caesium chloride to the product, a bluish-green *substance*,  $3\text{CsCl}\cdot 2\text{RuCl}_2\cdot\text{H}_2\text{O}$ , is precipitated which rapidly oxidises in the air.

E. G.

## Mineralogical Chemistry.

**Formation of Coal.** By S. STEIN (*Chem. Centr.*, 1901, ii, 950 ; from *Magy. chem. folyóirat*, 6, 39—42).—Wood was heated with water in sealed tubes, as in the experiments of Cagniard de la Tour, and black masses resembling coal obtained ; these gave the following results on analysis :

Temperature.	Time.	H per cent.	C per cent.
245°	9 hours	5·4	64·30
250	6 "	5·1	69·20
255	6 "	5·2	70·3
265	5 "	4·7	72·8
275	6 "	4·5	74·0
280	5 "	4·1	77·6
290	5 "	3·8	81·3

The increase in the amount of carbon depends on the pressure as well as on the temperature and duration of the experiment, since at atmospheric pressure for 2 days at a red heat the amount of carbon never exceeded 78 per cent.

L. J. S.

**A Variety of Polydymite or Sychnodymite.** By WILH. STAHL (*Zeit. Kryst. Min.*, 1901, 35, 289 ; from *Berg-u. hüttenm. Zeit.*, 1899, 58, 182).—Light to dark grey, cubic crystals from the Sieghthal gave on analysis :

Cu.	Ni.	Co.	Fe.	S.	Insol.	Total.
23·46	5·70	26·80	3·86	39·28	0·47	99·57.

This gives the same general formula  $(\text{Co}, \text{Cu}, \text{Ni}, \text{Fe})_4\text{S}_5$ , as both polydymite and sychnodymite, and approaches the latter in the proportions in which the metals are present.

L. J. S.

**Pyrites and Marcasite.** By HENRY N. STOKES (*Bull. U.S. Geol. Survey*, 1901, No. 186 [*Ser. E., Chem. & Physics*, No. 35], 1—50).—When pyrites and marcasite are not distinctly crystallised it is often

difficult to distinguish between them, and the characters usually relied on for this purpose, namely, colour, sp. gr. and ease of oxidation, are not altogether trustworthy. It is pointed out that the true colour of marcasite is tin-white, the usual bronze-yellow being due to tarnish. The author has devised a chemical method for the discrimination of these minerals, and for their quantitative determination in mixtures. This method depends on the fact that when pyrites or marcasite is boiled with an excess of a solution of a ferric salt until the latter is completely reduced, the ratio of sulphur oxidised to mineral decomposed is perfectly definite and characteristic of each mineral, provided certain standard and easily controllable conditions are observed. With a boiling solution of iron ammonium alum containing 1 gram of ferric iron and 16 c.c. of 25 per cent. free sulphuric acid per litre, the percentage of sulphur oxidised in pyrites is about 60.4, and in marcasite about 18 per cent. of the total sulphur. These figures are the characteristic oxidation coefficients, which depend, however, on the temperature and concentration of the solution. The oxidation of pyrites or marcasite to ferrous salt, sulphuric acid and free sulphur cannot be expressed by any single equation, but takes place according to two or more. An empirical curve for the oxidation coefficients of mixtures of pyrites and marcasite in known proportions gives a means of quantitatively determining the composition of naturally occurring mixtures of these minerals. The influence of various impurities on the results is described: the nature of the impurities can sometimes be distinguished by this method, for example, whether chalcopyrite or bornite is present in cupriferous pyrites. The determinations are made in an atmosphere of carbon dioxide, and a detailed description is given of the apparatus employed.

Some of the experiments which have been made (Abstr., 1895, ii, 316; 1896, ii, 108; 1898, ii, 602; 1901, ii, 319) with the view of determining the state of combination or valency of iron in pyrites, &c., are here repeated, only to show that the evidence derived from such experiments is inconclusive.

L. J. S.

**Hydrogöthite, a Definite Hydrated Iron Oxide.** By J. SAMOILOFF (*Zeit. Kryst. Min.*, 1901, 35, 272—274).—In 1889, P. A. Zemjatschensky described as a new mineral, under the name hydrogöthite, a hydrated iron oxide with the formula  $3\text{Fe}_2\text{O}_3 \cdot 4\text{H}_2\text{O}$ ; it was found as thin veins in limonite in central Russia, and had a fibrous structure and cochineal-red colour. These observations, which have not been generally accepted, are confirmed by the present author, who considers hydrogöthite to be a definite mineral species; and he records its occurrence in the iron-ores of several localities in the Tula government. It occurs as thin veins in, and as crusts 2—5 mm. thick on, massive limonite, and also as a later formation in the interior of hollow limonite concretions. Analysis gave:  $\text{H}_2\text{O}$ , 12.33—13.16;  $\text{Fe}_2\text{O}_3$ , 86.01 per cent., agreeing with the above formula: phosphorus, aluminium and traces of manganese are also present. The observed sp. gr., 3.73, is probably too low. The powder of the mineral is tile-red in colour.  $\text{H} = 4$ . Under the microscope are seen transparent plates

or needles with a distinct cleavage in one direction, straight extinction, optically positive in the direction of the length, and very strong pleochroism.  
L. J. S.

**Ktypeite and Conchite.** By HEINRICH VATER (*Zeit. Kryst. Min.*, 1901, 35, 149—178).—Conchite (Abstr., 1901, ii., 168, 395) is identical with aragonite, and the same is probably also true of ktypeite (Abstr., 1898, ii, 604).  
L. J. S.

**Analyses of Magnesite [and Dolomite].** By JOZSEF LOCZKA (*Zeit. Kryst. Min.*, 1901, 35, 282).—The following analyses are given of: I, grey magnesite, and II, white dolomite, both from Jolsva, Gömör Co., Hungary:

	MgO.	CaO.	MnO.	FeO.	Fe <sub>2</sub> O <sub>3</sub> .	CO <sub>2</sub> .	FeS <sub>2</sub> .	Insol.	Total.
I.	44·63	—	0·16	3·88	trace	51·34	0·19	0·04	100·24
II.	21·10	30·28	trace	0·98	trace	47·61	—	0·04	100·01

L. J. S.

**Pseudogaylussite.** By CHARLES O. TRECHMANN (*Zeit. Kryst. Min.*, 1901, 35, 283—285. Compare Abstr., 1898, ii, 80).—A description, with photographic reproductions, is given of some crystals dredged up from the Clyde at Cardross opposite Greenock. They are of a reddish-brown colour, with curved faces and rounded pyramidal terminations; in cross-section they are square or rhomb-shaped. Sp. gr. 2·575 and 2·602, but the material is slightly porous. Thin sections under the microscope show the material to consist mainly of minute (0·165 mm. diam.) spherules of calcite with radially fibrous structure. Analysis gave:

Ca <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub> .	CaCO <sub>3</sub> .	MgCO <sub>3</sub> .	Total.
5·52	83·52	9·03	98·07

Traces of silica, iron, manganese, chlorine, sulphuric anhydride and organic matter are also present. No new light is thrown on the origin of these peculiar pseudomorphs, which are also known by the names thinolite and jarrowite.  
L. J. S.

**Artificial Preparation of Monetite.** By AUGUST DE SCHULTEN (*Chem. Centr.*, 1901, ii. 1128; from *Bull. Soc. franç. Min.*, 24, 323—326).—Crystals of anhydrous dicalcium phosphate or monetite have been prepared by slowly dropping a 0·6 per cent. solution of ammonia into a solution containing 70 grams of anhydrous calcium chloride, 226 grams of disodium hydrogen phosphate (Na<sub>2</sub>HPO<sub>4</sub>·12H<sub>2</sub>O) in 500 c.c. of water and 80 c.c. of hydrochloric acid of sp. gr. 1·19. After remaining 2—3 weeks, dicalcium phosphate was found to have crystallised in transparent, triclinic plates [*a*:*b*:*c*=1·049:1:1·044] having a sp. gr. 2·928 at 15°. This preparation resembles, and may possibly be identical with, Kloos' martinite, Ca<sub>5</sub>H<sub>2</sub>(PO<sub>4</sub>)<sub>4</sub>· $\frac{1}{2}$ H<sub>2</sub>O which has a sp. gr. 2·894.  
E. W. W.

**Stilbite and Foresite from the Elba Granite.** By ERNESTO MANASSE (*Jahrb. Min.*, 1901, ii, Ref. 28—31; *Atti Soc. Toscana Sci. Nat. Mem.*, 1900, 17, 203—227).—Stilbite occurs as a yellowish-white mass encrusting the tourmaline and other minerals in drusy cavities in the Elba granite. Analysis I is of radial aggregates of small crystals, and II of globular and sheaf shaped groups; in both cases, details are given of the amounts of water expelled at various temperatures. The first of these analyses agrees with the usual stilbite formula, which, according to Clarke's theory of the silicates (Abstr., 1897, ii, 50), is written as  $[\text{Al}(\text{SiO}_4)_3\text{AlH}_5]\text{Ca}[\text{Al}(\text{Si}_3\text{O}_8)_3\text{CaH}_3\text{Al}], 8\text{H}_2\text{O}$ . This is referred to as typical stilbite. The second analysis with more silica requires one of the  $(\text{SiO}_4)$  groups in this formula, to be replaced by the group  $(\text{Si}_3\text{O}_8)$ , whilst in an earlier analysis by Grattarola and Sansoni with less silica, there are only two  $(\text{Si}_3\text{O}_8)$  groups:

	H <sub>2</sub> O.	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	CaO.	Na <sub>2</sub> O.	K <sub>2</sub> O.	Total.
I.	17.75	56.59	17.73	7.03	1.73	—	100.83
II.	14.94	61.51	15.01	6.74	1.91	—	100.11
III.	16.66	48.93	27.56	5.16	1.14	trace	99.45

Foresite occurs like the stilbite, but is snow-white. It gave on analysis the results under III, agreeing with those required for the formula  $13\text{H}_2\text{O}, 12\text{SiO}_2, 4\text{Al}_2\text{O}_3, 2(\text{Ca}, \text{Na}_2)\text{O}$ , which is written in conformity with Clarke's structural formula of stilbite by replacing  $\text{H}_4$  by four  $\text{Al}(\text{OH})_4$  groups.

In discussing the origin of these zeolites, the following analyses are given of the Elba granite. I (also traces of  $\text{MnO}$  and  $\text{ZrO}_2$ ) of the normal biotite-granite; II (also trace of  $\text{MnO}$ ) of dark, fine-grained patches in the same; III, (also trace of  $\text{B}_2\text{O}_3$ ) of white veins containing the tourmaline druses:

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	<u>FeO<sub>3</sub>.</u>	<u>FeO.</u>	CaO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	P <sub>2</sub> O <sub>5</sub> .	H <sub>2</sub> O.	Total.
I.	69.92	15.68	4.57	1.85	0.92	3.18	4.35	0.24	0.59	101.30	
II.	70.21	15.72	5.03	2.11	1.07	3.25	3.66	0.29	0.48	101.82	
III.	75.17	14.05	0.21	0.32	0.16	4.57	5.00	—	0.45	99.93	

The orthoclase of this granite has the following composition; I, for the fresh material, II, for the slightly altered, and III, for the much altered material; whilst IV gives the composition of a zeolitic mixture representing a still further stage in the alteration of the felspar:

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	CaO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Total.
I.	64.85	18.14	—	0.24	11.41	4.14	0.81	99.59
II.	51.64	23.98	0.18	3.82	[5.01]		15.37	100.00
III.	45.44	32.88	trace	2.08	[4.63]		14.97	100.00
IV.	61.54	17.04	trace	4.92	1.75	2.03	13.70	100.98

The alteration of the orthoclase to zeolites has been effected by water charged with carbon dioxide.

L. J. S.

**Formation of Pseudophite in Granitic Rocks.** By H. STADLINGER (*Zeit. Kryst. Min.*, 1901, 35, 313—315; from *Sitz.-Ber. phys.-med. Soc. Erlangen*, 1899, 31, 1—63).—Large porphyritic crystals of fresh



microcline, with some intergrown plagioclase, from the granite of Strehlerberg in the Fichtelgebirge, gave on analysis the results under I; sp. gr. 2·559. The following stages in its alteration are traced out, the end product being pseudomorphs of pseudophite, of which the composition is given under II; sp. gr. 2·6397. The microcline first loses its lustre and becomes coated with rusty-brown limonite; later, in the outer zone and along cleavage cracks, it becomes green; still later, the felspar is completely kaolinised, the colour passing to greyish-green, and finally to dark olive-green. Under the microscope, the following stages are recognised: complete kaolinisation of the enclosed laths of plagioclase; commencing turbidity of the microcline; formation of secondary quartz and muscovite; destruction of the 'cross-hatched' structure; development in the exterior portions of a green colour and of scales of lithia-iron-mica; accumulation of rutile needles; appearance of zircon; finally, the destruction of the grains of kaolin and the remains of the felspar.

The analysis of the "pseudophite" shows it to be a chloritic substance intermediate between pennine and clinocllore; its composition can be expressed as 62·71 amesite molecules and 47·29 antigorite molecules. A granular dolomite at the granite contact explains the large increase in the amount of magnesia:

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	MnO.	CaO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O. at 100°.	Loss on ignition.	Total.
I.	62·96	19·36	0·40	1·18	—	0·90	0·86	11·94	2·51	0·09	0·24	100·44
II.	30·30	20·06	1·63	5·30	—	0·87	28·28	1·32	1·40	0·74	11·89	101·79
III.	45·80	6·52	18·03	6·13	1·52	4·63	1·76	1·17	1·39	9·90	3·95	100·80

Analysis III is of nontronite, which occurs near Strehlerberg as an alteration product of a schistose amphibolite: the material analysed contained some undecomposed hornblende, as well as a little mica, magnetite, and quartz.

L. J. S.

[Analyses of Garnet and Gold.] By W. REISS and A. STÜBEL (*Zeit. Kryst. Min.*, 1901, 35, 298—301; from *Geologische Studien in der Republik Colombia. II. Petrographie, Berlin*, 1899).—The following mineral analyses are contained in an account of the minerals of Colombia. Rhombic dodecahedra of garnet of a greenish-grey colour, sometimes reddish in the interior, and optically anomalous, from La Topa, gave the following results. The magnesia probably belongs to enclosed malacolite.

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	CaO.	MgO.	Loss on ignition.	Total.
40·03	21·14	2·37	34·46	2·03	0·53,	100·56

Alluvial gold from various localities gave, on analysis by Kollbeck, the following results; small amounts of copper and iron are also present:

Au.	80·43	83·33	89·00	77·53	84·84	71·13	72·29	87·98	83·49
Ag.	17·89	13·56	9·43	20·89	13·63	24·09	24·42	11·03	14·79

L. J. S.

Theory of Tourmaline Mixtures. By GUSTAV TSCHERMAK (*Zeit. Kryst. Min.*, 1901, 35, 209—219. Compare *Abstr.*, 1900, ii, 217).—A reply to Penfield (*Abstr.*, 1900, ii, 602). The author upholds the

view that the composition of tourmalines can be better expressed by the isomorphous mixing of two definite compounds rather than by the substitution formula of Penfield.

L. J. S.

**A Stony Meteorite which fell at Felix, Alabama.** By GEORGE P. MERRILL (*Proc. U.S. Nat. Museum*, 1901, 24, 193—198).—This stone, weighing 2049 grams, was seen to fall on May 15th, 1900, near Felix in Perry County, Alabama. The broken surfaces are dark smoky grey, almost black in colour. The material is soft and friable and is very fine grained, with numerous small chondrules. Sp. gr. 3·78. The microscopic structure is described as follows: in a very dense, dark grey, seemingly amorphous base are scattered olivine, augite and enstatite in the form of fragments and chondrules, and interspersed with occasional minute blebs of native iron and troilite. From analyses by P. Fireman of the metallic portion and of the soluble and insoluble silicates, the composition of the stone is:

Fe.	Ni.	Co.	Cu.	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Cr <sub>2</sub> O <sub>3</sub> .	FeO.	FeS.
2·59	0·36	0·08	0·01	33·57	3·24	0·80	26·22	4·76
MnO.	NiO, CoO.	CaO.	MgO.	K <sub>2</sub> O	Na <sub>2</sub> O.	C.	H <sub>2</sub> O.	Total.
0·68	1·01	5·45	19·74	0·14	0·62	0·36	0·16	99·79

The mineralogical composition is: metal 3·04, troilite 4·76, chromite 1·17, graphite 0·36, soluble silicate (olivine in part) 72·60, insoluble silicate (enstatite and augite in part) 18·07 = 100·00.

L. J. S.

## Physiological Chemistry.

**Physical and Chemical Phenomena of Respiration at High Altitudes during a Balloon Ascent.** By J. TISSOT and HALLION (*Compt. rend.*, 1901, 133, 949—951).—At altitudes up to 3500 metres the proportion of oxygen absorbed and carbon dioxide exhaled increases with the altitude, so that the blood takes up practically the same quantity of oxygen per minute, whatever the altitude up to the limit stated. The volume of air inhaled, measured at the actual temperature and pressure, varies little, but tends to diminish at high altitudes. The variations in the respiratory quotient follow an order the inverse of that which would be followed if the exhaled carbon dioxide obeyed the laws of solutions of gases.

C. H. B.

**Changes in the Hæmoglobin of Blood under low Atmospheric Pressure.** By J. VALLOT (*Compt. rend.*, 1901, 133, 947—949).—Experiments were made at different heights on Mont Blanc and in a balloon, the quantity and rate of reduction of the hæmoglobin being determined by means of Henocque's hæmatospectroscope. The results

show that a reduction in the pressure of the air at once produces an increase in the activity of the exchanges in human blood, and thereby compensates for the diminution in the mass of oxygen in a given volume of the air. The activity of the reduction is practically the inverse of its duration, since the actual quantity of hæmoglobin in the blood varies but little, even at high altitudes. Mountain sickness is due to an increase in the duration of reduction, and the fatigue of climbing tends to prevent the diminution in the duration of reduction and may produce the same change as accompanies mountain sickness. Rest at high altitudes promotes the re-establishment of the physiological functions. After descent, the return to normal conditions is slower the longer the sojourn at a high altitude and the more complete the acclimatisation to it.

C. H. B.

**Dissociation of Carboxyhæmoglobin.** By NESTOR GREHANT (*Compt. rend.*, 1901, 133, 951—952).—A dog was allowed to breathe first air containing 1 per cent. of carbon monoxide for 12 or 15 minutes and then air or oxygen, the quantity of carbon monoxide in the blood being determined from time to time. The following figures, representing the quantity of carbon monoxide in 100 c.c. of blood, show that the elimination is much more rapid with oxygen than with air :

Time after poisoning	0	10	20	30	40	50	mins.
Breathing air.....	14·7	14·6	14·5	12·8	11·4	10·2	c.c.
Breathing oxygen...	23·7	16·9	10·1	8·2	5·7	4·2	c.c.

C. H. B.

**Metabolism in Man.** By L. SPIEGEL (*Virchow's Archiv*, 1901, 166, 364—371).—The investigation relates to the metabolism of sulphur compounds. In the oxidative decomposition of proteids in the body, cystin and hyposulphurous acid are constantly formed. These are not final products but are further oxidised under normal circumstances. The appearance of cystin or hyposulphites in the urine points to diminution of oxidation. The condition is compared to what occurs in regard to sugar in diabetics.

W. D. H.

**The Passage of Proteid through the Intestinal Wall.** By OTTO COHNHEIM (*Zeit. physiol. Chem.*, 1901, 33, 451—465).—The disappearance of peptone when in contact with the intestinal wall, as described by Hofmeister, Neumeister and others, does not depend on its assimilation or regeneration into ordinary proteid, but on its further decomposition into simpler decomposition products. This is accomplished by a special ferment, *erepsin*, secreted by the intestinal mucous membrane. Erepsin has no action on ordinary proteid, but only on peptone, and on a part of the proteoses. Leucine and tyrosine were separated from the products ; no tryptophan was found.

W. D. H.

**The Absorption of Substances insoluble in Water.** By HANS FRIEDENTHAL (*Pflüger's Archiv*, 1901, 87, 467—472).—Largely polemical, against Höber. In continuation of previous work, it is now shown that finely divided metallic mercury is absorbed ; this is mainly attributed to leucocytic action.

W. D. H.

**Molecular Concentration of the Blood and Tissues of Aquatic Animals.** By LÉON FREDERICQ (*Bull. Acad. Roy. Belg.*, 1901, No. 8, 428—454).—In the lowest animals, the blood or hæmolymp has the same molecular concentration and the same percentage of salts as the water in which they live. In the next stage of evolution, the molecular concentration is the same, but the amount of salt is less than in the sea-water. Finally, as the surfaces of exchange become more highly developed and less permeable, both the molecular concentration and the amount of salt are very different in the two fluids. The same three stages are seen in the tissues. Numbers obtained with numerous animals are given which support these propositions. W. D. H.

**Hæmolysis and Bacteriolysis.** By W. BULLOCK (*Trans. Path. Soc.*, 1901, 52, 208—245).—As a result of the injection of ox-blood into rabbits, a hæmolysin develops in three days; it consists of two substances, an 'immune substance,' and a thermo-unstable complement. Experiments show it is possible to make quantitative estimations of these substances. The appearance of the immune substance is coincident with an increase of mono-nuclear leucocytes; it is probably formed in the lymphatic tissues, whilst the complement is probably formed in myeloid tissue. The immune substance is excreted in the milk; this partly explains the immunity of the offspring; the hæmolysin, however, reaches the fœtus mainly by the placenta. There is a close analogy between hæmolysis and bacteriolysis.

W. D. H.

**Natural Anti-hæmolysins.** By BESREDKA (*Ann. Inst. Pasteur*, 1901, 15, 785—807).—Both man and animals make normally for their own red corpuscles an anti-hæmolysin which is very probably an anti-auto-hæmolysin.

W. D. H.

**Influence of Salts on Heart Muscle.** By WILLIAM H. HOWELL (*Amer. J. Physiol.*, 1901, 6, 181—206).—The experiments were performed on the ventricular muscle of the terrapin's heart. Spontaneous contractions depend on the presence of both calcium and sodium compounds. Sodium salts tend to produce relaxation; calcium salts increase its tone, and this may pass into a condition of rigor. Potassium chloride antagonises this effect of calcium chloride, but only to a marked extent when sodium salts are present in approximately normal proportions. When all these salts are present, automatic contractibility is maintained longer. Strips of the ventricle do not contract spontaneously in the animal's own serum or an equivalent Ringer's mixture; this is due to the inhibitory influence of the potassium salts. When the heart is placed in a 0.7 per cent. solution of sodium chloride, the effects observed are first due to the gradual loss of potassium from the heart muscle by diffusion, and the final disappearance of the beats is due to a similar loss of calcium.

W. D. H.

**Copper in the Liver of Cephalopods.** By MARTIN HENZE (*Zeit. physiol. Chem.*, 1901, 33, 417—425).—The relationship of the liver of vertebrates to the iron of the blood suggested a similar investigation of the cephalopod liver in reference to copper. The



blood of these animals is free from iron. The blood-free liver contains a small amount of iron, but the amount of copper is about ten times as great. Both metals are united to nucleo-proteid. Dastre and Floresco (*Arch. de Physiol.*, 1898, 10, 289) describe two pigments in the liver of these animals, one is insoluble in water but soluble in chloroform; this xanthophylloid pigment is free from both metals; the other pigment, which is soluble in water, was prepared in an impure form and contains from 1.3 to 7.7 per cent. of copper, 0.7 per cent. of iron and 4.7 per cent. of phosphorus. W. D. H.

**Chemical Constituents of Tendon.** By LEO BUEGER and WILLIAM J. GIES (*Amer. J. Physiol.*, 1901, 6, 219—231).—The average composition of the tendon Achilles is thus given :

	Calf.	Ox.
Water .....	67.51	62.87
Solids .....	32.49	37.13
Inorganic matter.....	0.61	0.47
Organic matter .....	31.88	36.66
Fat .....	—	1.04
Albumin and globulin .....	—	0.22
Mucoid.....	—	1.28
Elastin.....	—	1.63
Collagen .....	—	31.58
Extractives (creatine, purine bases, &c.) .....	—	0.89

W. D. H.

**The Fat of the Egg of the Common Fowl.** By THOMAS E. THORPE (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 155—161).—Eggs from pure bred hens (Horsley) and from hens of mixed breeds (High Pitfold) gave ratio of yolk to white, 1:1.92 and 1:1.62 respectively. The percentage of fat in the yolk was 31.7 in the Horsley eggs and 30.6 in the High Pitfold eggs, corresponding with 9.4 per cent. of fat in the former eggs and 10.2 in the eggs from High Pitfold. The fat from the Horsley eggs contained 0.6 per cent. of phosphorus, corresponding with 15.04 per cent. of lecithin, 61.5 per cent. of neutral fat, and 23.2 per cent. of free acids. The neutral fat had a saponification value of 181.5 and contained 93.1 per cent. of insoluble and 2.04 per cent. of soluble (total 95.14 per cent.) acids. The saponification value of the insoluble acids was 189.6 (mol. wt.=296). When calculated on the assumption that only triglycerides were present, there should be 95.93 per cent. of fatty acid (in agreement with 95.14 per cent. found) and 9.86 per cent. of glycerol, whilst if monoglycerides alone were present there should be only 87.79 per cent. of fatty acid and 29.58 per cent. of glycerol. Determination of the glycerol showed 9.6 per cent. (mean) in the fat. Results obtained with the High Pitfold eggs also show that only triglycerides are present in the fat. J. McC.

**Proteids of Cow's Milk.** By GUSTAV SIMON (*Zeit. physiol. Chem.*, 1901, 33, 466—541).—This paper is mainly concerned with quantitative methods. A large number of methods for the estimation of total proteids and of the individual proteids are carefully compared. Analyses of cow's milk and colostrum are given. W. D. H.

**Physiological Action of Decoction of Mussels.** By CONSTANT THIBERT (*Bull. Acad. Roy. Belg.*, 1901, No. 8, 494—499).—In decoction of mussels there exists a substance which on intravenous injection in the dog produces a lowering of arterial pressure, an increased production of lymph, and a non-coagulable condition of the blood. The action is similar to that produced by 'peptone.' The active substance was not isolated. Glycogen takes no part in the effects. W. D. H.

**The Action of Pilocarpine and Atropine on Echinoderm Embryos.** By ALBERT P. MATHEWS (*Amer. J. Physiol.*, 1901, 6, 207—215).—Atropine sulphate, in small doses, hinders the development and gives rise to dwarf embryos. Pilocarpine hydrochloride hastens development and gives rise to abnormally large embryos. The action of atropine resembles that of hydrogen ions, the action of pilocarpine that of hydroxyl ions. Hence atropine and pilocarpine act on animal cells directly, and not merely on secretory nerve-endings. It is suggested that atropine inhibits, and pilocarpine increases, oxidation processes, and that this will explain their action on secretory cells.

W. D. H.

**Pathogenic Properties of Trypsin and the Antitryptic Power of Guinea-pig's Serum.** By PIERRE ACHALME (*Ann. Inst. Pasteur*, 1901, 15, 737—752).—The introduction into animals, subcutaneously or intraperitoneally, of trypsin, a substance capable of profoundly altering 'living proteid,' provokes immediately a process of defence. This consists of an exudation of blood-serum (? plasma or lymph) under the influence of vaso-motor nerves. The exudation opposes the penetration of the trypsin and then neutralises its effects. When this is frequently repeated, the process of defence is more perfect and this is due to an increase in the antitryptic power of the serum. W. D. H.

**Intravenous Inoculation of a Diplococcus isolated from Cases of Rheumatic Fever.** By F. J. POYNTON and ALEXANDER PAINE (*Trans. Path. Soc.*, 1901, 52, 248—253).—Rheumatism appears to be due to a diplococcus which can be separated from heart, lungs, joints, &c., of rheumatic fever patients. When it is intravenously injected into rabbits, arthritis is the usual result.

W. D. H.

**Analysis of the Urine in a Case of Osteomalacia.** By THOMAS (*J. Pharm. Chim.*, 1901, [vi], 14, 437—438).—The paper contains complete analyses of the urine both before and after administration of calcium glycerophosphate. The effect of the calcium glycerophosphate is to render the urine much more normal in composition. H. R. LE S.

**Concretions from the Urinary Duct of a Wild Boar and from the Kidney of a Deer.** By CONSTANTIN COUNCLER (*Chem. Zeit.*, 1901, 25, 872—873).—A concretion from the urinary duct of a wild boar (*Sus scrofa*) consisted almost entirely of pure crystallised magnesium ammonium phosphate. A second concretion from the kidney of a deer (*Cervus capreolus*) consisted of pure crystallised calcium oxalate,  $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ .

J. J. S

## Chemistry of Vegetable Physiology and Agriculture.

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**The Effect of Nitrates on certain Bacteria.** By WALTER C. C. PAKES (*Trans. Path. Soc.*, 1901, 52, 246—247).—The effect of high percentages of nitrates on the morphology of certain bacteria is described. The bacilli resume their original form when again planted on broth. W. D. H.

**The Lactic Ferments in the Arts.** By MARTINUS W. BEYERINCK (*Arch. Néer. sci. exact. nat.*, 1901, [ii], 6, 212—243).—The ferments used in producing lactic acid have been exhaustively studied. The bacteria are *Lactococci* and *Lactobacilli*. Lactic fermentation is not a mere enzymic action, but is a true catabolic process. Experiments with pure cultures of lactic ferment prove that the quantity of acid formed is dependent on the temperature (optimum 41°) and on the presence or absence of air. The author applies the name *Lactobacillus delbrücki* to all those species which can be isolated from the ferment by the gelatinised must method; *L. delbrücki* is not the active agent of a good industrial ferment. *Lactobacillus fermentum* has also been isolated from the ferment and it is shown that this is the bacterium which gives the ferment its particular character. Cultivated under good aëration, it gives only lactic acid and no volatile acids; its optimum is 41—42°, its minimum 25°, and its maximum 50°.

*L. fermentum* can be transformed into *L. delbrücki* by cultivation above the optimum temperature and by prolonged cultivation under very profuse aëration; the reverse transformation can be carried out by an aërobic culture at the ordinary temperature. J. McC.

**Decomposition of Butter Fat by Micro-organisms.** By O. LAXA (*Arch. Hygiene*, 1901, 41, 119—151).—The most active agents in the decomposition of butter fat among those examined were the moulds, *Oidium lactis*, *Penicillium glaucum*, and a species of *Mucor*, as well as *Bacillus fluorescens liquefaciens*. Several varieties of yeast and of bacteria which are able to peptonise casein were found to have only a slight action, whilst a number of varieties of lactic acid bacteria and of *Thyothrix* were found to be inactive. The decomposition of the fat is not due to the action of ammonia produced from the nitrogenous matter by the action of the organisms, as has been suggested by Duclaux, since solutions of ammonia do not act on the fatty glycerides at the ordinary temperature. In the cases of *Penicillium* and *Mucor*, it was found possible, by grinding the mould with glass powder and filtering, to obtain a sterile solution containing an enzyme which decomposed monobutyrim and butter fat in the characteristic manner. Of the glycerides of the insoluble acids, those of highest molecular weight are first decomposed. On the other hand, the glycerides of the soluble acids of lowest molecular weight are most largely decomposed. This appears to be connected with the fact that the higher soluble acids exert a very strong deterrent effect on the growth of the organisms. The free volatile fatty acids are then further decomposed by the action of the mould. Experiments with casein freed from fat show that no

part of the fatty acid produced is derived from the casein, but that the organism is able to synthesise a small amount of fat which is stored in its cells as reserve material. A. H.

**Formation of Volatile Acids in Alcoholic Fermentation.** By W. SEIFERT (*Bied. Centr.*, 1901, 30, 774—776; from *Zeit. landw. Versuchs-Wes. Oesterr.*, 1901, 4, 227).—Volatile acids were not produced in any quantity (0.6 gram per litre being the largest amount) in must by Tokay yeast. When greater amounts occur in wines, their presence must be attributed to moulds or acetic acid bacteria. Differences in temperature had very little effect on the formation of volatile acids, but rather more was produced at 15° than at 30°. The presence of tartaric or malic acid had no appreciable effect. The amount of non-volatile acid was distinctly increased during fermentation; addition of tartaric or malic acid to the must somewhat diminished the production of non-volatile acid. N. H. J. M.

**Production of Hydrogen Sulphide in Alcoholic Fermentation.** By W. SEIFERT (*Bied. Centr.*, 1901, 30, 776—778; from *Zeit. landw. Versuchs-Wes. Oesterr.*, 1901, 4, 221).—The results of fermentation experiments with 0.2 gram of sulphur in 250 c.c. of must showed that the greatest production of hydrogen sulphide took place after the vigour of the fermentation had begun to diminish. The amount of sulphide produced in two weeks was 0.0073 gram per litre.

It was found that the presence of sulphur in the amount employed quickened the fermentation as compared with fermentation in absence of sulphur. This is shown to be probably partly due to mechanical action, wood and paper fibre having a similar effect. In practice, the amount of sulphur would be considerably less than 0.8 gram per litre and insufficient to exercise either a mechanical or an antiseptic action.

In the aëration of must, the stirring and distribution of the yeast is probably of greater importance than the access of air. N. H. J. M.

**Fluorine in Musts and Wines.** By KARL WINDISCH (*Zeit. Nahr. Genussm.*, 1901, 4, 961—968).—See this vol., ii, 104.

**Chemical Processes in the Killed Yeast Cell.** By ROBERT ALBERT and W. ALBERT (*Centr. Bakt. Par.*, 1901, ii, 7, 737—742).—When yeast which has been killed by treatment with alcohol and ether is suspended in water, coagulable albumin and non-coagulable proteids pass out of the cell and are rapidly digested by the proteolytic enzyme of the yeast, which does not appear to be affected by the treatment with alcohol. The liquid filtered after 48 hours still contains this proteolytic enzyme together with the products of its action. Microscopic examination shows that this change is accompanied by the disappearance of material from the cell, deeply staining granules being left, which afterwards also disappear, leaving a small mass, capable of being stained, which is possibly the nucleus of the cell. The zymase of the cell, although still active and capable of bringing about the fermentation of the glycogen within the cell or of sugar solution, does not pass out of the cell. It seems probable also that the glycogen is first hydrolysed by another ferment, which, like the zymase, remains in the cell, since glycogen added to the solution is neither hydrolysed



nor fermented. The zymase itself is destroyed in about 20 hours by the proteolytic enzyme. Invertase also passes out of the cells so rapidly when they are placed in water that a solution of considerable inverting power is formed which only contains traces of albumins; attempts are being made to prepare pure invertase by this means.

A. H.

**Respiration of Hydrogen and Hydrocarbons through the Green Parts of Plants.** By GINO POLLACCI (*Chem. Centr.*, 1901, ii, 938—939; from *Atti R. Ist. Bot. Univ. Pavia*).—The production of formaldehyde in the green parts of plants is attributed to the action of nascent hydrogen. Both hydrogen and hydrocarbons were found to be given off by plants.

N. H. J. M.

**Nutrition of Plants at the Expense of the Cotyledons.** By GUSTAVÉ ANDRÉ (*Compt. rend.*, 1901, 133, 1011—1013).—The amounts of dry matter, ash, silica, calcium, phosphoric acid, potassium, and nitrogen were determined in Spanish haricots and in the cotyledons and plants at intervals of two days, commencing nine days after sowing the seeds. The results are arranged to show the gradual exhaustion of the cotyledons and the coincident increase in the plants of the various constituents.

Silica and calcium are absorbed from the commencement, being, as previously shown, withdrawn from the soil by the cotyledons. Nitrogen and phosphoric acid remain unchanged for some time, the grain in the plant being accounted for by corresponding losses in the cotyledons. The assimilation of phosphoric acid from the soil commences at the same time as the assimilation of soil-nitrogen. The absorption of potassium from the soil commences as soon as the germinating period ends.

N. H. J. M.

**Chlorophyllous Assimilation in the Autumn.** By JEAN FRIEDEL (*Compt. rend.*, 1901, 133, 840—841).—On repeating his experiments with glycerol extracts of leaves (*Abstr.*, 1901, ii, 411) in October and November, the author obtained negative results. It was, however, found that, at this time of the year, assimilation is very feeble in the leaves themselves. Further experiments will be made in the spring.

N. H. J. M.

**Mechanism of Esterification in Plants.** By EUGÈNE CHARABOT and A. HÉBERT (*Bull. Soc. Chim.*, 1901, [iii], 25, 955—959. Compare *Abstr.*, 1901, ii, 619).—Rhodinol is esterified more readily than geraniol; under comparable conditions, 83 per cent. of the rhodinol, and 67 per cent. of the geraniol are converted into the acetate. In a sample of Algerian geranium-oil, it was found that the esters contained a larger proportion of rhodinol than the free alcohols, showing that esterification in the plant obeys the usual laws, and that the esterified alcohols found in the plant are those which are most readily esterified under laboratory conditions.

T. M. L.

**Composition of the Reserve Carbohydrates of the Proteid of the Seeds of some Liliaceæ, and in particular of Butcher's Broom.** By GEORGES DUBAT (*Compt. rend.*, 1901, 133, 942—944).—Air-dried seeds of *Ruscus aculeatus* (with 9.88 per cent. of water)

yielded 0.97 per cent. of fatty matters and when digested for half-an-hour with 0.3 per cent. sulphuric acid on a water-bath, 13.616 per cent. of reducing sugar, calculated as invert sugar. A certain amount of lævulose was separated as calcium lævulosate.

When hydrolysed, the seeds yielded 69.85 per cent. of reducing sugars: mannose, 27.92; dextrose (?), 27.64; invert sugar, 13.61, and pentoses, 0.68 per cent.

N. H. J. M.

**Origin of Starch in Wheat Grain.** By PIERRE P. DEHÉRAIN and C. DUPONT (*Compt. rend.*, 1901, 133, 774—778).—Whilst the total nitrogen of a wheat crop does not increase after the commencement of maturation (Isidore Pierre, *Recherches expér. sur la développement du blé*, 1866; DehéRAIN and Meyers, *Abstr.*, 1883, 493; and Berthelot, *Chim. Veg. Agric.*, 2, 259), there is a migration of nitrogen from the lower to the upper leaves, followed by a concentration in the grain.

In the case of starch, there is at no period a reserve of amylaceous matter, such as occurs in potatoes, tobacco, &c. The rapid accumulation of starch during the last weeks is therefore due to the elaboration of new substance, notwithstanding that the green portions of the plants are by this time very restricted. It is now shown that the green upper portions of the stems have the functions of leaves in decomposing carbon dioxide. It is further shown that whilst nitrogen and reducing sugars remain in the upper parts of the stems, the starch, dextrin, and non-reducing sugars migrate for the most part to the ears, where they are concentrated as starch.

The late production of starch, and its dependence on the stems remaining green, is illustrated by the results of field experiments in 1888 and 1889, when the weather was wet and dry respectively during the period of maturation. In 1888, the weight of grain was 3445 kilos., and contained 439 kilos. of nitrogenous matter, and 2689 kilos. of starch; in 1889, the yield of grain was 2922 kilos., and it contained 447 kilos. of nitrogenous matter and 1808 kilos. of starch per hectare.

N. H. J. M.

**Prussic Acid in Sweet Cassava.** By PATRICK CARMODY (*Lancet*, 1900, Reprint).—The presence of hydrocyanic acid in sweet cassava, first pointed out by Francis (*Abstr.*, 1877, ii, 515), is confirmed. It is further shown that the acid is located chiefly in the skin and outer cortical layer, whereas in the bitter cassava it is uniformly distributed throughout the tuber.

E. G.

**Chemistry of Stylophorum Diphyllum.** By JULIUS O. SCHLOTTERBECK and H. C. WATKINS (*Pharm. Review*, 1901, 19, 453—458).—*Stylophorum diphyllum*, commonly known in America as the yellow or celandine poppy, belongs to the *Papaveraceæ* and grows in the low woods from Ohio to Tennessee and westward to Wisconsin and Missouri. The following alkaloids were found to be present in the plant as salts of chelidonic acid: (1) chelidonine, for which the formula proposed by Schmidt and Selle is confirmed by analyses of the alkaloid and its salts; it is a tertiary base and contains no methoxy-groups. (2) A new alkaloid, *stylophine*,  $C_{19}H_{19}O_5N$ , of which the chloride, nitrate, hydriodide, aurichloride, and platinichloride have

been analysed ; it does not contain methoxy-groups and is probably a tertiary base ; (3) protopine ; (4) a new alkaloid, *diphylline* which melts at  $216^{\circ}$  ; (5) sanguarine, identical with that found in *Sanguinaria*, *Chelidonium*, and *Bocconia*. Potassium chelidonate is present in the plant in considerable quantity. Besides the above substances, the plant also contains a crystalline colouring matter probably identical with chelidoxanthin, and a fragrant substance resembling coumarin in odour.

H. R. LE S.

**Does Argemone Mexicana contain Morphine?** By JULIUS O. SCHLOTTERBECK (*Pharm. Review*, 1901, 19, 458—461).—Mexican or prickly poppy (*Argemone mexicana*) does not contain morphine ; the only alkaloids present are berberine and protopine. The alkaloid isolated from this plant by Peckolt, to which he gave the name argemonine, is probably identical with protopine.

H. R. LE S.

**Chemical Composition of the Roots of Dorstenia Klaineana (Gabon Ivy) and D. Brasiliensis.** By EDOUARD HECKEL and FRÉDÉRIC SCHLAGDENHAUFFEN (*Compt. rend.*, 1901, 133, 940—942).—The root of *Dorstenia Klaineana*, a shrub common in the French possessions in Africa, has a brick-red bark and a strong odour of coumarin. It contains *ψ-coumarin*,  $C_{12}H_5O_3$ , which melts at  $180^{\circ}$  and is soluble in light petroleum ; various red resins, characterised by giving an intense cochineal coloration in contact with bromine vapour ; tannin, and a large quantity of starch.

The root of *D. Brasiliensis* yields to light petroleum a crystalline substance which melts at  $189^{\circ}$  and gives a golden-yellow colour with strong sulphuric acid, a deep brown colour with a mixture of sulphuric and selenious acids ; a golden-yellow colour, becoming violet and then blue, with sulphuric and iodic acids, and a violet tint changing to blue with sulphuric acid and potassium dichromate. The root also contains resins which seem to be identical with those from *D. Klaineana*. Both roots contain a very large proportion of inorganic matter, the ash consisting of calcium and ferric oxides, the latter in large quantity, as also are the sulphates, no chlorides, but a small quantity of phosphates.

C. H. B.

**Feeding Experiments, with Milch-sheep and Goats, on the Effect of Fat on the Amount and Composition of the Milk.** By C. BEGER, P. DOLL, G. FINGERLING, E. HANCKE, H. SIEGLIN, W. ZIELSTORFF and AUGUST MORGEN (*Chem. Zeit.*, 1901, 25, 951—953).—Fat, when fed in the form of sesame cake or earth-nut oil, has, under certain conditions, a considerable effect on the amount of fat in the milk, and it is probable that these fats serve, at any rate to some extent, as materials for the production of milk-fat.

When the fat of a ration having a nutritive ratio of 1:3.6—3.7, and containing 1 gram of fat per kilo. of live weight, is replaced to the extent of four-fifths by an equivalent amount of carbohydrates, the milk-fat produced was reduced by about 14 grams per day, or about 34 per cent. of the normal amount.

Whilst a reduction in the amount of food-fat diminished the fat in

the dry matter of the milk by 7.1 per cent., there was invariably an increase in the amounts of sugar, nitrogen, and ash. An increased amount of food-fat up to a certain point increased the amount of milk-fat but not the other constituents.

The effect of food-fat in increasing the milk-fat is limited, and an excess of fat produces different effects with different animals.

N. H. J. M.

**Composition of Hard Wheat and the Physical Constitution of its Gluten.** By ÉMILE FLEURENT (*Compt. rend.*, 1901, 133, 944—947).—Analyses are given of Russian and African wheat grain and of Canadian goose wheat. Hard wheat contains above 2.5 per cent. of proteids more than soft wheat, and more gluten than the most highly nitrogenous soft wheats. The sum of the gluten and starch in wheat is a constant amount (65 per cent.), and the sum of the sugars and the soluble nitrogenous matters is also constant (5 per cent.). The results of determinations of gliadin in the flour of hard wheat by means of the two methods described by the author (*Compt. rend.*, 132, 1421, and 133, 327 and 754) are not concordant, owing to hard wheat containing 1.5 to 2 per cent. more soluble matter than soft wheat; even when the densimeter results are subjected to a correction, the results are much too low. This is due to the presence in the gluten of hard wheat of a considerable amount of conglutin. The gluten of flour from Russian wheat, for instance, contained gliadin 46.45, glutenin 37.89, and conglutin 15.66 per cent.

N. H. J. M.

**Composition of the Products Resulting from the Grinding of Wheat by means of Millstones and Rollers.** By LÉON LINDET (*J. Pharm. Chim.*, 1901, [iv], 14, 433—437).—The superiority of roller milling over the ordinary grinding by millstones is clearly seen from the analyses of the different constituent parts into which the wheat is separated by the two processes.

H. R. LE S.

**Influence of Single Manures on Barley.** By J. J. VANHA (*Bied. Centr.*, 1901, 30, 745—750; from *Zeit. landw. Versuchs-Wes. Oesterr.*, 1901, 4, 40).—Nitrogenous manure increases the yield of grain and straw much more than other manures, and, like potash, promotes root-growth. With increased root-production, there is also an increase in the number and weight of stems. The weight of single stems is, however, only increased by a mixture containing nitrogen, potassium, and phosphorus in moderate quantities. The length of the stems is increased by phosphates or potassium manure (up to 100 kilos. per hectare) and diminished by much nitrogenous manure. The number of ears is influenced much more by nitrogen than by phosphoric acid and potassium; the latter are without advantage in quantities greater than 100 kilos. per hectare. Nitrogenous manures, and in a much less degree, potassium and phosphoric acid, increase the number of grains by increasing the number of ears. All these manures, but especially nitrogen, increase the weight of grain; potassium seems to influence the volume of the grain the most. Phosphoric acid increases, whilst large amounts of nitrogen and potassium diminish, the mealiness of the



grain. The amounts of total nitrogen and of proteids are considerably reduced by phosphoric acid and potassium. Potassium is deposited to a greater extent in the straw than in the grain, whilst phosphoric acid is deposited chiefly in the grain.

N. H. J. M.

**Experiments with Varieties of Barley.** By JOSEPH HANAMANN (*Chem. Centr.*, 1901, ii, 1126—1127; from *Zeit. landw. Versuchs-Wes. Oesterr.*, 4, 993—1006).—The results of experiments with old Bohemian and different Scotch varieties of barley showed that the heaviest and best variety (goldfoil) deteriorated most, notwithstanding the favourable climatic conditions. The other acclimatised varieties remained unaltered. The local conditions greatly affected the percentage of nitrogen.

The application of kainite resulted in a satisfactory gain in yield, whilst the amount of proteids was reduced.

The average percentage of nitrogen in a large number of samples of barley grown during ten years was 1.44.

N. H. J. M.

**Influence of Manuring on the Composition of Potatoes.** By WALTER F. SUTHERST (*Chem. News*, 1901, 84, 258—259).—Analyses were made of potatoes grown (1) without manure, (2) with 20 tons of farmyard manure, and (3) 5 cwt. of superphosphate, 2 cwt. of potassium chloride, and 2 cwt. of ammonium sulphate per acre. The following percentage results were obtained :

	Dry Matter.	N.	Starch.	Ash.	K <sub>2</sub> O.	CaO.	P <sub>2</sub> O <sub>5</sub> .
1.	23.76	0.506	17.76	0.967	0.628	0.025	0.124
2.	21.92	0.516	13.56	0.973	0.635	0.022	0.147
3.	24.05	0.493	17.14	0.964	0.630	0.028	0.121

The similarity in the composition of the tubers from plots 1 and 3 is attributed to the absence of sufficient moisture in the soil to dissolve the artificial manures.

The starch was determined gravimetrically with Fehling's solution, after heating 3 grams of the dried substance successively with water at 108° and with dilute hydrochloric acid.

N. H. J. M.

**Value of the Nitrogen in Pyrenean Phosphates.** By JULES JOFFRE (*Bull. Soc. Chim.*, 1901, [iii], 25, 960—961).—The small amount (0.14 per cent.) of nitrogen in phosphates from the Pyrenees was found to be of no agricultural value.

T. M. L.

**Mixtures of Martin-slag and Degelatinised Bone-meal as Diluents for Basic Slag.** By FRANZ W. DAFERT and F. PILZ (*Chem. Centr.*, 1901, ii, 895; from *Zeit. landw. Versuchs-Wes. Oesterr.*, 4, 960—963).—An alleged sample of basic slag was separated by means of bromoform into a light portion (57 per cent.) consisting of degelatinised bone meal, and a heavy portion (40 per cent.), found to be martin-slag. The phosphate contained total P<sub>2</sub>O<sub>5</sub>, 16.63 per cent. and 14.3 per cent. soluble in citric acid solution.

N. H. J. M.

## Analytical Chemistry.

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**Simple Gasometric Method of Estimating Chlorine, Hydrochloric Acid, Silver, and Phosphates.** By E. RIEGLER (*Zeit. anal. Chem.*, 1901, 40, 633—638).—Silver chloride, treated with hydrazine sulphate and sodium hydroxide, is decomposed according to the equation  $4\text{AgCl} + \text{N}_2\text{H}_4 \cdot \text{H}_2\text{SO}_4 + 6\text{NaOH} = 4\text{Ag} + 4\text{NaCl} + \text{Na}_2\text{SO}_4 + 6\text{H}_2\text{O} + \text{N}_2$ . By calculation, 1 part of nitrogen corresponds with 20.424 parts of silver chloride: experiment gives 20.2 parts. The silver chloride (not more than a gram), precipitated and washed in the usual manner, is placed, together with about 0.5 gram of hydrazine sulphate, in the reaction flask of a Knop-Wagner azotometer, the inner vessel of which is charged with 10 c.c. of a 10 per cent. sodium hydroxide solution. After the temperature has been adjusted, as usual, the contents of the flask are shaken for 15 minutes, the temperature readjusted, and the volume of gas read off.

For the estimation of phosphoric acid, a quantity of a phosphate containing not more than 0.16 gram of  $\text{P}_2\text{O}_5$  is dissolved in dilute nitric acid, treated with 1—2 grams of silver nitrate and then with sufficient sodium hydroxide to produce a permanent precipitate, the precipitation of brown silver oxide being avoided. Dilute ammonia is then added until the liquid is alkaline to litmus paper, and the mixture boiled for 5 minutes. The silver phosphate is collected and washed, then dissolved in nitric acid. The silver is precipitated as chloride and estimated as above. One milligram of nitrogen is obtained for each 3.33 mg. of  $\text{P}_2\text{O}_5$ .  
M. J. S.

**Fluorine in Musts and Wines.** By KARL WINDISCH (*Zeit. Nahr.-Genussm.*, 1901, 4, 961—968).—Mention is made of several instances where the must from Spanish grapes could not be induced to ferment, owing, as it appeared afterwards, to the presence of a fluoride. The various methods for the qualitative detection of fluorine are reviewed, and preference is given to the test by etching glass.

An accurate estimation of fluorine in foods is still a *desideratum*. The great difficulty seems to be the prevention of loss of fluorine by volatilisation when reducing the substance to ash.  
L. DE K.

**Estimation of Sulphur in Iron Pyrites.** By R. AUZENAT (*Chem. Centr.*, 1901, ii, 1093; from *Mon. sci.* 1901, [iv], 15, 11, 635).—0.5 gram of the sample is oxidised with nitrohydrochloric acid with addition of 20 c.c. of a 10 per cent. solution of sodium chloride. The excess of acid may then be evaporated at  $120^\circ$  without any fear of losing sulphuric acid. At least six hours should elapse before collecting the barium sulphate.  
L. DE K.

[Discrimination between and Estimation of Pyrites and Marcasite in Mixtures.] By HENRY N. STOKES (*Bull. U.S. Geol. Survey*, 1901, No. 186, Ser. E., Chem. and Physics, No. 35).—See this vol., ii, 87.

**Estimation of Persulphates.** By CHARLES A. PETERS and SETH E. MOODY (*Amer. J. Sci.*, 1901, [iv], 12, 367—376).—The authors have investigated the various processes in use for the estimation of persulphates. The process introduced by Leblanc and Eckardt (reduction with ferrous sulphate and titration of the excess with permanganate) is simple, rapid, and convenient. Grützner's method (reduction at the boiling point with arsenious acid in alkaline solution and titration of the excess with iodine) is not trustworthy without a correction. Mondolfo's process (heating with potassium iodide and titrating the liberated iodine with thiosulphate) is simple and fairly rapid, but tends to give too low results. The method recently proposed by Namias where the potassium iodide is allowed to act for twelve hours in the cold also gives low results.

Gooch and Smith's process for the estimation of chlorates (*Abstr.*, 1892, ii, 236) by means of arsenic acid and potassium iodide may also be applied to persulphates; the results are accurate, but the process is less simple than the other methods.

L. DE K.

**Estimation of Alkali Persulphates.** By G. ALLARD (*J. Pharm. Chim.*, 1901, [vi], 14, 506—508).—The method usually employed for the estimation of alkali persulphates, which consists in the estimation of the iodine liberated when a solution of potassium iodide is added to the persulphate solution, is accurate only when carried out in neutral solution. If carried out in sulphuric acid solution, as recommended by Moreau (*Bull. Soc. Pharm.*, 1901, 3, 179), the results are too high, due to the fact that the sulphuric acid liberates iodine from the potassium iodide.

H. R. LE S.

**Rôle of Phosphoric Acid in Wine Analysis.** By RUDOLF WÖY (*Zeit. öffentl. Chem.*, 1901, 21, 415—420).—Phosphoric acid, although no longer regarded as of much importance in judging the purity of a wine, is to be considered as a disturbing factor in estimating the other constituents of wine ash. The author has already explained that part of the acid may be converted into pyrophosphoric acid and so escape precipitation with molybdate solution (*Abstr.*, 1901, ii, 344). It is now shown that the potassium carbonate of the wine ash acts to some extent on the calcium phosphate with formation of calcium carbonate and potassium phosphate. The estimation of the alkalinity, according to the German official process, becomes, therefore, slightly incorrect in the presence of much phosphoric acid. The matter requires further investigation.

L. DE K.

**Methods for the Analysis of Artificial Manures.** By F. KRETSCHMER (*Zeit. angew. Chem.*, 1901, 14, 1136—1138).—Conventional methods are given for the partial or full analysis of phosphatic and nitrogenous artificial manures.

L. DE K.

**Analysis of Mixtures of Alkali Silicates, Carbonates, Sulphates and Hydroxides.** By GEORG LUNGE and W. LÖHNER (*Zeit. angew. Chem.*, 1901, 14, 1125—1134).—The idea that sodium silicate is completely decomposed by barium chloride is incorrect; about 40

per cent. remains in solution and apparently increases the free alkalinity. The presence of silicic acid introduces an error when phenolphthalein is used as indicator on account of its acidic properties; the silica is, however, rendered inert if the liquid contains sufficient sodium chloride. Solutions containing carbonate may be fairly accurately titrated with phenolphthalein as indicator, provided they are sufficiently diluted and contain sodium chloride, or, what amounts to the same thing, a fair proportion of sodium hydroxide; the concentration of the alkali should not exceed one gram-mol. of sodium chloride per litre. For the estimation of the total alkali, the best process is titration with hydrochloric acid in the presence of methyl-orange. The following scheme is given for the technical analysis of the soda cake used in the manufacture of fibre: 1. *Insoluble matter* is estimated as usual. 2. *Alkalinity*. Twenty c.c. of the solution (50 grams dissolved to 500 c.c.) are titrated with *N*-hydrochloric acid and phenolphthalein until colourless and the titration is then continued with methyl-orange as indicator. 3. *Sodium sulphide and sulphite*. Twenty c.c. are diluted to 200 c.c., acidified with acetic acid, and rapidly titrated with *N*/10 iodine. 4. *Sodium sulphite only*. One hundred c.c. are precipitated with an alkaline solution of zinc acetate, the whole is diluted to 250 c.c., and filtered; 50 c.c. of the filtrate are then again acidified with acetic acid and titrated with iodine. 5. *Sodium silicate*. Twenty c.c. are evaporated with addition of hydrochloric acid and the silica separated as usual. 6. *Sodium sulphate*. The filtrate from the silica is precipitated with barium chloride as usual. The usual calculation is then applied.

L. DE K.

**Modification of Schumann's Apparatus for Estimating the Specific Gravity of Cement.** By P. BECK (*Zeit. anal. Chem.*, 1901, 40, 646—649).—Instead of oil of turpentine, carbon tetrachloride is employed; its lower viscosity shortens the operation materially. The adjustment of the liquid to the zero of the graduation is facilitated by having a hole in the side of the neck, and another in the graduated tube, which can be brought into communication by rotating the tube in the neck. Several additional devices enable a series of estimations to be performed rapidly.

M. J. S.

**Examination of Mixtures of Portland Cement and Slag Meal.** By P. BECK (*Zeit. anal. Chem.*, 1901, 40, 649—666).—Recent experiments by W. Fresenius show that a high consumption of permanganate (see Abstr., 1884, 876) can no longer be regarded as a criterion of the adulteration of Portland cement with slag meal. Attention has therefore been directed to the estimation of the sulphur existing as sulphide, this being the most characteristic constituent of slag when compared with genuine cement. Three methods were employed: (1) The total sulphur was estimated by fusing the substance with alkali carbonates and nitrate and heating the solution with nitric acid; the sulphur present as sulphate was also estimated after boiling the substance with hydrochloric acid. The difference was assumed to represent the sulphur of the sulphides. (2) The substance was decomposed by boiling with hydrochloric acid in a current of carbon dioxide



and the hydrogen sulphide absorbed by cadmium chloride, as in Fresenius' method of estimating sulphur in cast iron. (3) The consumption of permanganate by the substance was ascertained, and also the amount of permanganate required after the substance had been digested in the cold with dilute sulphuric acid and a cadmium salt. The difference, calculated according to the equation  $6\text{KMnO}_4 + 5\text{S} = 3\text{K}_2\text{O} + 6\text{MnO} + 5\text{SO}_3$ , agreed closely with the amount of sulphide-sulphur estimated according to method (1) in the slag-meal itself, and with the calculated amount in mixtures of the slag-meal with a sample of Portland cement which did not contain sulphides. This method is the most rapid of the three. It is carried out exactly as follows: The weighed substance (1 gram) is made into a paste with 50 c.c. of water in a flask, 100 c.c. more water are added and an excess of permanganate solution (5 grams per litre) with vigorous shaking, then immediately 50 c.c. of dilute sulphuric acid in small portions. By adding the reagents in this order, all loss of hydrogen sulphide is prevented. An excess of titrated ferrous ammonium sulphate solution is then added and the excess titrated back with the permanganate. A similar experiment is then made, in which 1—2 grams of cadmium carbonate are added to the wetted cement instead of the permanganate. Sulphuric acid is added as before and the flask is filled with carbon dioxide and corked. When the mixture has become clear, it is filtered and the filtrate immediately titrated with a permanganate solution one-fifth the strength of the former one.

M. J. S.

**Volumetric Estimation of Manganese.** By FRED IBBOTSON and HARRY BREARLEY (*Chem. News*, 1901, 84, 247—248).—In the bismuthate process, 1.1 grams of the metal are dissolved in 35 c.c. of nitric acid of sp. gr. 1.20, and bismuthate added to the cooled solution until a permanganate colour persists or manganic oxide separates on boiling. The solution is cleared with hydrogen peroxide, sulphurous acid or ferrous sulphate, cooled, treated with 10 c.c. of water and excess of bismuthate, filtered, washed with 3 or 4 per cent. nitric acid, mixed with excess of ferrous ammonium sulphate, and titrated with decinormal permanganate. With hydrogen peroxide, the results are liable to be too high. The presence of chromium only affects the results in warm solutions or when contact with the bismuthate is prolonged. Tungsten does not affect the reaction, but any hydrofluoric acid must be eliminated. Titanium and vanadium may prove troublesome and molybdenum is so when hydrogen peroxide is used, but not with ferrous sulphate (compare Ramage, this vol., ii, 50).

D. A. L.

**Volumetric Estimation of Manganese.** By LAWRENCE DUFTY (*Chem. News*, 1901, 84, 248).—0.1 gram of steel is dissolved in 2 or 3 c.c. of nitric acid according to the amount of carbon present, the carbon estimated, the solution diluted with nitric acid in a test-mixer to 20 c.c., when the manganese is under 0.8 per cent. or otherwise to 25 c.c., and then mixed with 0.2 gram of bismuthate. After settling, 5 c.c. of the clear solution are compared colorimetrically with a standard. The process is a modification of that of Reddrop and Ramage (*Trans.*, 1895, 67, 268).

D. A. L.

**Volumetric Estimation of Manganese.** By HUGH RAMAGE (*Chem. News*, 1901, 84, 269. Compare preceding abstracts).—The author defends his statements against criticisms of Ibbotson and Brearley, and expresses disapproval of the use of ferrous sulphate or ammonium ferrous sulphate as a substitute for hydrogen peroxide in the manner suggested by those authors. Moreover, he prefers titration to the colorimetric method of Dufty. D. A. L.

**New Process for the Estimation of Manganese.** By GEORG VON KNORRE (*Zeit. angew. Chem.*, 1901, 14, 1149—1162).—Marshall (*Trans.*, 1891, 59, 771—786) has stated that manganous salts when mixed with potassium persulphate yield manganese dioxide. The author has succeeded in making this the basis of a quantitative estimation. Solutions of manganous salts, which must first be converted into sulphate, on boiling with excess of ammonium persulphate yield the whole of the metal as dioxide, which may then be collected and treated either gravimetrically or volumetrically. In the presence, however, of copper, nickel, zinc, iron, or cobalt, the dioxide carries down a portion of these metals; in the absence of cobalt, good results may even then be obtained by applying the volumetric process with standard hydrogen peroxide (or ferrous sulphate) and standard potassium permanganate.

The process may be successfully applied to the estimation of not too small proportions of manganese in iron-spar and nickel-steel; also in "spiegeleisen" and ferromanganese. L. DE K.

**Volumetric Estimation of Iron.** By OTTO SCHMATOLLA (*Chem. Centr.*, 1901, ii, 1094; from *Pharm. Zeit.*, 1901, 46, 810).—When reduced iron is tested by the process of the German Pharmacopœia, the addition of potassium iodide retards the solvent action of the iodine; the following modification is therefore proposed: 0.3 gram of the sample is put into a stoppered flask with 5—10 c.c. of water and 1.6 grams of coarsely powdered iodine, the flask is placed in cold water and frequently shaken until the iodine has dissolved. After remaining for half an hour at the ordinary temperature, the excess of iodine is titrated with *N*/10 thiosulphate.

When pulverised iron is tested, the freshly prepared sulphuric acid solution should be diluted to 200 c.c. A portion is placed in a burette and slowly added to about 2 c.c. of a 2—3 per cent. solution of potassium permanganate until this is perfectly clear and decolorised. It is then mixed with iodine (? potassium iodide) and treated according to the Pharmacopœia process. L. DE K.

**Method of Quantitatively separating Nickel and Zinc.** By ARTHUR ROSENHEIM and ERNST HULDSCHINSKY (*Ber.*, 1901, 34, 3913—3916. Compare Abstr., 1901, ii, 533).—Zinc forms a complex salt with ammonium thiocyanate,  $(\text{NH}_4)_2\text{Zn}(\text{SCN})_4 \cdot 4\text{H}_2\text{O}$ , which crystallises in white needles readily soluble in cold water; it closely resembles the corresponding cobalt compound (*loc. cit.*), and like the latter is insoluble in a mixture of ether and amyl alcohol. This property is used to separate zinc from nickel for the purposes of

quantitative estimation of a mixture of the two metals. The details of the process are similar to those previously described in the separation of nickel and cobalt (*loc. cit.*). Alloys of copper, zinc, and nickel, argentan, nickellin, and german silver, have been analysed by this process and the results compared with those obtained by the usual method; the agreement is very good.

K. J. P. O.

[Detection of Olefines in Light Petroleum.] By LUIGI BALBIANO and V. PAOLINI (*Chem. Zeit.*, 1901, 25, 932—933).—Two or three c.c. of the rectified sample boiling below  $100^{\circ}$  are shaken for 2 to 3 minutes with 10—12 c.c. of a cold saturated solution of mercuric acetate and then set aside in a closed tube for 24 to 36 hours. If then the aqueous liquid is turbid from the presence of small, white, lustrous lamellæ, the presence of an olefine is proved. The aqueous layer may contain aldehydes or ketones; processes are given for their identification.

L. DE K.

Determination of the Refractive Index of Ethereal Oils. By F. UTZ (*Chem. Centr.*, 1900, ii, 1130; from *Apoth. Zeit.*, 16, 742—746).—The author used for his recent determinations an Abbé refractometer with prisms that can be heated. It became necessary to ascertain whether the index-division shown on the sector, which is calculated for the ordinary temperature, is available for higher temperatures; it appears that a correction is only requisite when the temperature exceeds  $50^{\circ}$ , but, considering the other sources of error, this is not of much practical interest. The same may be said about the increase of the dispersion of the glass with increase in temperature. However, at every observation the temperature should be recorded. The refractive index of a large number of ethereal oils is given for  $15^{\circ}$ ,  $20^{\circ}$ ,  $25^{\circ}$ , and  $30^{\circ}$ , and also the degree of dispersion at  $15^{\circ}$ . As a result of this investigation, the author has somewhat modified his previous view that the refractive index may serve to distinguish oils free from terpenes from the ordinary ethereal oils. This is only true in the case of a comparatively small number of ethereal oils, for instance, oils of lemon, fennel, juniper, sassafras, &c. The determination of the refractive index may, however, give a valuable clue as to the age of the oil, as it increases by long keeping; it will detect admixture of foreign ingredients if these possess a different refractive index from that of the oil and it will often tell the particular part of the plant from which the oil has been prepared.

L. DE K.

Detection and Decomposition of Iodoform. By C. H. L. SCHMIDT (*Chem. Centr.*, 1901, ii, 1095; from *Arch. internat. Pharm. Therap.*, 1901, 8, 110).—A starch solution, coloured blue by the presence of iodine, is mixed with dilute sulphuric acid and filtered from the iodide of starch. The filtrate is mixed with nitrite, which will then show the presence of hydriodic acid. Any precipitate is collected, and the filtrate mixed with zinc dust, which decomposes the iodoform and causes a further blue precipitate. By means of this reaction the author has found that iodoform gives off iodine at  $100^{\circ}$  and even at  $80^{\circ}$  in the presence of air; in the presence of water or

glycerol and air, part of the iodine is converted into hydriodic acid. Besides iodine, some carbon dioxide and carbon monoxide are also formed. The presence of the latter may be proved by heating the iodoform at  $100^{\circ}$  in a current of air and passing the vapours first through water and then through blood.

L. DE K.

**Detection of Iodoform in the Presence of some Organic Iodine Compounds.** By C. H. L. SCHMIDT (*Chem. Centr.*, 1901, ii, 1095; from *Arch. internat. Pharm. Therap.*, 1901, 8, 187).—In the presence of isopropyl iodide, allyl iodide, or di-iodohydrin, iodoform may be detected by taking advantage of the fact that, like allyl iodide, it may be decomposed or extracted by mercury or chloroform, whilst isopropyl iodide is only extracted by chloroform, and di-iodohydrin is neither decomposed by mercury nor extracted by chloroform. The presence of albumin does not interfere with the reaction. When iodoform, suspended in glycerol, is heated for a long time at  $100^{\circ}$ , carbon monoxide and carbon dioxide are evolved and the liquid contains free iodine, hydriodic acid, and traces of isopropyl iodide. The latter is formed by the action of hydriodic acid on the allyl iodide, obtained by the action of iodine on glycerol. Allyl iodide is only temporarily present in the liquid and may be detected by its odour and physiological action.

L. DE K.

**Detection of Methyl Alcohol in Ethyl Alcohol.** By JOSEF HABERMANN and A. OESTERREICHER (*Zeit. anal. Chem.*, 1901, 40, 721—724).—The method is based on the fact that an alkaline solution of potassium permanganate is decolorised much more rapidly by methyl alcohol than by ethyl alcohol. To 10 c.c. of the liquid to be tested, which must contain nothing except water and the respective alcohols (10 per cent.), two drops of a 10 per cent. solution of potassium hydroxide, and then one or two drops of *N*/10 permanganate are added. With ethyl alcohol, the colour takes about 5 minutes to pass through violet and green to yellow, the green stage lasting for several minutes; if methyl alcohol is present, however, the change to yellow is so rapid that the intermediate colours can scarcely be observed. Liquids containing less than 5 per cent. of methyl alcohol require a preliminary fractional distillation.

M. J. S.

**Detection and Estimation of Methyl Alcohol in Commercial Formaldehyde.** By MAURICE DUYK (*Ann. Chim. anal. appl.*, 1901, 6, 407—409).—One hundred c.c. of the sample previously diluted with half its bulk of water are placed in a cooled flask and ammonia is slowly added in slight excess; if after a few hours the liquid still does not react with phenolphthalein, a little more ammonia should be added. A little sodium carbonate is added in order to render the hexamethylenetetramine more stable and the liquid is distilled until 100 c.c. have passed over. The distillate is neutralised with dilute sulphuric acid and redistilled in a bulb apparatus, and the fractions passing over between  $65^{\circ}$  and  $100^{\circ}$  are collected. These are again rectified so as to obtain a distillate containing three-fourths of its bulk of methyl alcohol. The methyl alcohol is finally estimated by converting it



into methyl iodide. For every 5 c.c., 10 grams of iodine and 2 grams of amorphous phosphorus are added; after a few hours the mixture is heated in a reflux apparatus and the whole distilled. The methyl iodide is collected in a graduated measure over water and from its volume that of the methyl alcohol is calculated. Commercial samples of formaldehyde have been found to contain from 3 to 10 per cent. of methyl alcohol.

L. DE K.

**Estimation of Glycerol.** By SIMON ZEISEL and R. FANTO (*Chem. Centr.*, 1901, ii, 1131; from *Zeit. landw. Versuchs-Wes. Oesterr.*, 4, 977—979).—The glycerol is boiled in a reflux apparatus with hydriodic acid (b. p. 127°), which soon converts it into isopropyl iodide. This may then be distilled and its iodine estimated by means of Zeisel's alcoholic solution of silver nitrate.

L. DE K.

**Quantitative Separation of Cholesterols from Fats.** By E. RITTER (*Chem. Zeit.*, 1901, 25, 872).—Fifty grams of fat are heated on the water-bath in a large porcelain basin with 100 c.c. of alcohol and a solution of 8 grams of sodium in 150 c.c. of 99 per cent alcohol. When the alcohol has volatilised, 75 grams of salt are added and then so much water that the greater part of the mass dissolves. The liquid is afterwards evaporated to dryness, first over the naked flame, then on the water-bath, and finally in a drying oven at 80°. The residue is finely powdered, put into a paper cartridge, and extracted with ether in a Soxhlet tube for 9 hours. Sand or paper cannot be substituted for the salt.

To remove traces of soap and glycerol, the ether is distilled, the residue dissolved in as little alcohol as possible, and reprecipitated by water. The cholesterol is collected on a filter and dried at 60°; the bulk of it is then transferred to a weighed flask and the last adhering particles are rinsed off with ether. The ether is evaporated and the residue dried at 100—120°.

L. DE K.

[**Estimation of Sugar in Beets.**] By R. S. HILTNER and R. W. THATCHER (*J. Amer. Chem. Soc.*, 1901, 23, 863—868).—A polemical reply to the criticism of Ewell (*J. Amer. Chem. Soc.*, 1901, 23, 432) on the method described by the authors for the estimation of sugar in beets (*Abstr.*, 1901, ii, 535).

E. G.

**Estimation of Volatile Acidity of Wines.** By XAVIER ROCQUES and G. SELLIER (*Ann. Chim. anal. appl.*, 1901, 6, 414—417).—The authors had previously devised (*ibid.*, 1898, 3, 222) an apparatus based on the same principle as that of Curtel (this vol., ii, 55). They think, however, that the sources of error mentioned by Curtel are not of sufficient importance notably to affect the results of the distillation process.

Another possible source of error, however, is that, if the wine should contain bisulphates and be concentrated to a very small volume, the tartaric acid will be acted on with formation of carbon dioxide and

an aldehyde which collects in the distillate and renders the titration slightly inaccurate. L. DE K.

**Estimation of Uric Acid.** By ADOLF JOLLES (*Zeit. physiol. Chem.*, 1901, 33, 542—546).—The author maintains, in opposition to Folin and Shaffer (Abstr., 1901, ii, 585), that his method (Abstr., 1900, ii, 450, 515) is accurate. W. D. H.

**Detection of Benzoic Acid and Alkali Benzoates in Food.** By J. DE BREVANS (*J. Pharm. Chim.*, 1901, [vi], 14, 438—440).—The sample to be tested is extracted with water (if a liquid, 200 c.c. are taken), the solution filtered, acidified with dilute sulphuric acid, and extracted three times with 50 c.c. of a mixture of equal volumes of ether and light petroleum. The residue left on evaporation of the ethereal solution may contain "saccharin," salicylic acid, and benzoic acid. If the first two are absent, the benzoic acid may be tested for in the following way. A small portion of the residue is placed in a dry test-tube, 2 c.c. of aniline containing 0.02 gram of rosaniline hydrochloride per 100 c.c. are added, and the mixture boiled for about 20 minutes, when, if benzoic acid is present, the liquid becomes red, then blue, and finally violet in colour. A few drops of dilute hydrochloric acid are next added, and the solid portion, which is now blue in colour, is collected, washed until all the violet colouring matter is removed, and finally dissolved in alcohol, when, if benzoic acid was originally present, the blue colour due to the aniline-blue formed is clearly seen.

H. R. LE S.

**Application of Iodine Monobromide in the Analysis of Fats and Oils.** By Jos. HANUŠ (*Zeit. Nahr.-Genussm.*, 1901, 4, 913—920).—Iodine monobromide may be easily prepared by slowly adding 13 grams of bromine to 20 grams of powdered iodine with constant stirring, and cooling to 5—8°. The reaction takes about 10 minutes for completion and the product is freed from any uncombined bromine by passing a rapid current of carbon dioxide over it. It constitutes a grey, crystalline, metallic-looking substance which should be preserved in a stoppered bottle. The author prefers to use its solution in glacial acetic acid instead of the well-known Hübl solution for the following reasons. Its strength is readily ascertained by adding potassium iodide and titrating with sodium thiosulphate, it keeps for a considerable time and it acts on fats with great rapidity, so that an iodine absorption takes only 10—15 minutes. In practice, it has been found convenient to dissolve 10 grams of the compound in 500 c.c. of glacial acetic acid.

0.6—0.7 gram of solid fats, 0.2—0.25 gram of oils having an iodine figure below 120, or 0.1—0.15 gram of oils showing a higher figure is dissolved in a beaker or stoppered flask in 10 c.c. of chloroform and 25 c.c. of the standardised iodine monobromide solution are then added from a burette. After standing for 10 minutes (fats) or 15 minutes (oils), 15 c.c. of solution of potassium iodide (1 : 10) are added, and the liberated iodine titrated with sodium thiosulphate without using starch. The results agree with those of Hübl. L. DE K.

**Systematic Inspection of Milk for Preservatives.** By ALBERT E. LEACH (*Analyst*, 1901, 26, 289—291).—Formaldehyde is tested for by heating to boiling in a porcelain casserole 10 c.c. of the sample with 10 c.c. of hydrochloric acid containing 1 c.c. of 10 per cent. ferric chloride per 500 c.c. The presence of formaldehyde is indicated by a more or less intense violet coloration. Although objection has been taken to this test on account of other colour reactions taking place, the author has never met with a sample giving this reaction, where the presence of formaldehyde could not also be proved by other tests.

The ash obtained in due course is moistened with a drop or two of dilute hydrochloric acid, when any effervescence will show the presence of sodium carbonate; the original sample is examined by the rosolic acid test for carbonate. A few c.c. of water are then introduced into the crucible and when the ash is dissolved it is tested in the usual way for boric acid with turmeric paper.

L. DE K.

**Detection of Margarine in Butter.** By CHARLES ANNATÒ (*Chem. Centr.*, 1901, ii, 836; from *Pharm. Zeit.*, 46, 693).—The butter prepared from the milk of three cows, which, in addition to their usual food, had also partaken of sesamé cakes, gave with the furfuraldehyde test a decided reaction for sesamé oil. The mere fact of this test being obtained does not, therefore, prove the presence of margarine. On account of its liquid nature, sesamé oil itself cannot be employed as a butter adulterant, but only so when in combination with tallow or similar fats.

L. DE K.

**Detection of Margarine in Dairy Products by means of the Sesamé Oil Test.** By HERMANN BREMER (*Chem. Centr.*, 1901, ii, 955; from *Pharm. Zeit.*, 46, 757—758).—The author strongly doubts Annatò's statement that butter prepared from the milk of cows which have been fed on sesamé cake gives the furfuraldehyde test for sesamé oil, and suggests that the test has been improperly applied. It is of the utmost importance that the butter-fat should be carefully filtered, so as to remove every trace of casein. It is, however, thought possible that a chemical extraction of the milk might yield a fat giving the reaction.

L. DE K.

**Detection of Sesamé Oil.** By PAUL SOLTSIEN (*Chem. Centr.*, 1901, ii, 1095; from *Pharm. Zeit.*, 46, 771—772).—A reply to Bremer. Even now the author would prefer the sugar to the furfuraldehyde test if the use of the latter had not been made obligatory [in Germany]. The fact, stated by Schrott and Fiechtl, that a solution of furfuraldehyde in hydrochloric acid gradually turns red, had been noticed independently by the author.

L. DE K.

**The Sesamé Oil Reaction in Butter Analysis.** By CHARLES ANNATÒ (*Chem. Centr.*, 1901, ii, 1095—1096; from *Pharm. Zeit.*, 46, 772).—A reply to Bremer. The author was fully aware of the precautions to be taken to ensure a successful sesamé oil reaction.

L. DE K.

**Detection of Margarine by means of the Sesamé Oil Reaction.** By HERMANN BREMER (*Chem. Centr.*, 1901, ii, 1096; from *Pharm. Zeit.*, 46, 818—819. Compare Abstr., 1900, ii, 325).—A reply to Soltsien and Annatò (preceding abstracts). L. DE K.

**Is the Sesamé Oil Reaction of a Butter a sufficient Proof of Adulteration.** By A. REINSCH (*Chem. Centr.*, 1901, ii, 1096; from *Milch. Zeit.*, 30, 643—644).—In the author's experience, every sample of butter which gave the sesamé oil reaction was found to contain margarine. Undoubtedly genuine butter never gave the reaction. It is a matter of regret that the feeding experiments of Vieth and Siegfeld have not been carefully repeated. L. DE K.

**Detection of Sesamé Oil.** By FERNAND RANWEZ (*Rev. intern. Falsif.*, 1901, 14, 125—127).—Soltsien has stated that the test with hydrochloric acid and furfuraldehyde is untrustworthy and has recommended the use of a solution of stannous chloride instead. The author states that the latter test is not delicate enough for the detection of small quantities of sesamé oil in butter, and has also proved by a number of experiments that the furfuraldehyde test may be safely used. In the absence of sesamé oil, no colour is developed for several hours and only on a prolonged contact is a brownish-yellow coloration gradually formed; this is not likely to be mistaken for the red colour caused by sesamé oil. L. DE K.

**Occurrence and Detection of Sesamé Oil in Commercial Arachis Oils.** By PAUL SOLTSIEN (*Chem. Revue*, 1901, 8, 202—203).—Tambron has stated that the fatty acids obtained from arachis oil, give, like sesamé oil, the Baudouin furfuraldehyde reaction. The author has fully investigated this matter and states that there is hardly any commercial arachis oil which does not contain sesamé oil either by actual adulteration or from the fact that often arachis oil is pressed after sesamé oil. Samples prepared by the author never gave the reaction.

When applying Baudouin's test to the fatty acids, it must be borne in mind that the active principle of sesamé oil is somewhat soluble in mineral acids and, in consequence, gets partly removed; however, the presence of 1 per cent. of sesamé oil in arachis oil may be safely detected when operating with the fatty acids; stannous chloride should not be substituted for furfuraldehyde as it causes the fatty acids to turn brown. L. DE K.

**Some Analyses of Bulgarian Butter derived from Buffaloes and Sheep, also of Bulgarian Lard and Walnut Oil.** By NIKOLAUS PETKOW (*Zeit. Nahr.-Genussm.*, 1901, 4, 826—828).—Analyses are given of fourteen samples of buffalo and 12 samples of sheep's butter, showing the amount of water, fat, non-fatty matters, sp. gr. of the fat at 100°, refraction, Reichert-Meissl number, Köttstorfer number, iodine number, insoluble fatty acids, and free acids (Burstyn's method). Both varieties of butter show no practical difference from cow's butter except in so far that the Reichert-Meissl numbers of the buffalo butter were higher than is mostly the case with cow's butter; they varied from 31.02 to 38.2.



Similar analyses of three samples of Bulgarian lard showed that this does not materially differ from other European lard. The average analysis of 5 samples of cold-pressed Bulgarian walnut oil gave: sp. gr. 0.9258, at 15°: refractometer number 67.7, at 40°: iodine number 148.21 and acidity (Burstyn) 4.38. L. DE K.

**A Sharp Indicator for Titrating Dark Coloured Fats.** By J. FREUNDLICH (*Chem. Centr.*, 1901, ii, 1094—1095; from *Oesterr. Chem. Zeit.*, 1901, 4, 441—442. Compare Abstr., 1900, ii, 41).—When phenolphthalein cannot be used as an indicator, the author recommends that for each titration 10 c.c. of a 2 per cent alcoholic solution of Alkali Blue II OLA should be used. L. DE K.

**New Gravimetric Estimation of Formaldehyde.** By LUDWIG VANINO (*Zeit. anal. Chem.*, 1901, 40, 720—721).—When added to a mixture of silver nitrate with an excess of sodium hydroxide, formaldehyde is oxidised to sodium formate with reduction of a corresponding amount of silver oxide to the metallic state. After being left for 15 minutes in the cold, secluded from light, the precipitate is digested three or four times with an excess of 5 per cent. acetic acid. This dissolves the unreduced silver oxide and the reduced metal can then be collected on a weighed filter, washed, dried, and weighed. M. J. S.

**Microchemical Examination of Tea and Observations on Caffeine.** By P. KLEY (*Rec. Trav. Chim.*, 1901, 20, [ii], 344—351).—About one-third of a tea leaf is mixed with an equal quantity of quicklime and of water, dried at 100°, and moistened with two to three drops of alcohol in a small filtering tube. The filtered solution is evaporated, the residue placed on a small mica plate, surrounded by a ring of asbestos and sublimed on to a glass cover slip. The sublimate generally consists of an amorphous centre with radiating needles; if the latter do not show, the plate is breathed on after drawing across it a platinum wire with which a crystal of caffeine has been broken. The whole of the amorphous mass gradually becomes crystalline. Tea leaves which have once been extracted do not give a sublimate of caffeine under these conditions.

On crystallising caffeine from water at 70°, short, thick needles are obtained with a rectangular extinction between crossed nicols, which are totally different from those of ordinary caffeine, the extinction of which is at 36°; the former crystals are anhydrous, the latter hydrated.

On subliming anhydrous caffeine to which a little water has been added, anhydrous crystals are deposited, unless the surface of deposition has upon it a trace of the hydrated substance; when this is present, the sublimate is hydrated. Hydrated caffeine loses the whole of its water over sulphuric acid. W. A. D.

**Detection of Nicotine by means of Formaldehyde.** By SCHINDELMEISTER (*Rev. intern. Falsif.*, 1901, 14, 129).—If a trace of nicotine is mixed with 1 drop of 30 per cent. formaldehyde, a solid residue is formed after some hours which gives an intense rose color-

tion when touched with a drop of strong nitric acid ; if resinous matter is present, a blood-red colour appears. After some time, the colour changes to green. A more permanent colour is obtained when instead of formaldehyde pure formic acid is used. The test is characteristic for nicotine and is not given by conicine and similar organic bases formed by putrefying meat.

L. DE K.

**Analysis of Raspberry Juice.** By EDUARD SPAETH (*Zeit. Nahr.-Gemussm.*, 1901, 4, 920—930) (continued from Abstr., 1901, ii, 291).—Full details are given for the detection of sugar substitutes (starch-syrup, "saccharin," dulcin), preservatives (salicylic acid, benzoic acid, calcium  $\beta$ -naphtholsulphonate [abastrol], alcohol, boric acid), organic acids, and esters by already known processes.

Raspberry juice, or syrup, when pure, is characterised by freedom from unfermentable polarising substances (dextrin) after treating the fermented solution with basic lead acetate, and also by the fact that the fixed acidity is mainly due to malic acid. The author also observes that the test for artificial colours as laid down in the German Pharmacopœia, namely, agitation with amyl alcohol, is not conclusive, but that it should be supplemented by the "wool test" and the usual tests for vegetable colours.

L. DE K.

**Estimation of the Alkalinity of Blood.** By AUGUSTE LUMIÈRE, LOUIS LUMIÈRE, and HENRI BARBIER (*Compt. rend.*, 1901, 133, 692—695).—The various methods of estimating the alkalinity of blood yield variable results, and the authors find that greater accuracy is secured if, after mixing the blood with excess of acid, the residual acid is determined by causing it to act on a mixture of potassium iodate and iodide and titrating the liberated iodine. With a constant quantity of acid and varying quantities of blood, however, the alkalinity decreases as the quantity of blood increases, but constant results are obtained if the quantity of acid added is proportional to the weight of blood taken. The alkalinity as thus determined represents the true alkalinity and a fraction of the total basicity of the blood.

C. H. B.

**Detection of Peptone in Urine.** By ZDENKO ČERNÝ (*Zeit. anal. Chem.*, 1901, 40, 592—595).—Urine is commonly examined for peptone either by saturating with ammonium sulphate or by precipitating with phosphotungstic acid and testing either precipitate for the biuret reaction. From urine rich in urobilin, that substance is also precipitated by both reagents, and likewise gives the biuret reaction. Bang has shown that the ammonium sulphate precipitate can be freed from urobilin by washing with alcohol. The author finds that if the phosphotungstic acid precipitate of urobilin is decomposed by barium hydroxide and the warm alkaline solution shaken with air, the urobilin becomes oxidised, with the possible exception of traces which are too small to produce the biuret reaction. The phosphotungstic precipitate obtained by Hofmeister's method is more easily oxidised than that prepared by Salkowski's method.

M. J. S.

## General and Physical Chemistry.

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**Dispersion of Ultra-violet Rays.** By F. F. MARTENS (*Ann. Phys.*, 1901, [iv], 6, 603—640).—A theoretical and physical paper, not suitable for abstraction. J. C. P.

**Radioactivity of Uranium** By HENRI BECQUEREL (*Compt. rend.*, 1901, 133, 977—980).—The author has previously found (Abstr., 1900, ii, 518) that if solutions of uranium compounds are mixed with a small quantity of a barium salt and the latter is precipitated, the radioactivity of the precipitate is considerably higher than that of the original uranium compound, whilst by several repetitions of this process the radioactivity of the uranium compound is greatly reduced. After the expiration of eighteen months, he has again examined the various products and finds that the uranium preparations have regained their original radioactivity, with practically the same intensity in all cases, whereas the barium precipitates have entirely lost their radioactivity, or, in other words, have behaved as if their very marked radioactivity was simply induced. The author considers that these results show that uranium compounds have a radioactivity of their own, although the possibility that the uranium may contain a small quantity of some specially radioactive substance not separated in the various operations is not excluded. The recovery of radioactivity is in all probability a phenomenon of auto-induction, and supports the author's view that the emission of rays not deviated in a magnetic field is due to the emission, by the same substance, of deviable rays, just as Rontgen rays are produced by the impact of cathode rays. The author has repeated his observations on the radioactivity of uranium compounds at the temperature of liquid air, and confirms his previous result. C. H. B.

**Researches on Contact Electricity.** By OSCAR KNOBLAUCH (*Zeit. physikal. Chem.*, 1901, 39, 225—244).—The author determined the sign of the charge left on plates of platinum, paraffin, glass, and sulphur, on the removal of various powders which had been placed on the plates. Seventy-five different compounds were employed, including acids, bases, neutral salts, and various organic products. Platinum and paraffin become positively charged if the powder is of an acid nature, negatively if it is alkaline, whilst for neutral compounds the charge left is sometimes positive, sometimes negative. Sulphur becomes positively charged by contact with acid powders, but negatively in almost all other cases; glass, however, becomes negatively charged, except when the powder is of an alkaline nature. These results are satisfactorily explained on the assumption that plates and powders are coated with a film of the saturated aqueous solution; when an acid powder is placed on the platinum or paraffin plate and the films are hence in contact, the hydrogen ions, on account of their greater velocity, pass in excess into the platinum surface film, so that when

the powder is removed, the plate is positively charged. Similar reasoning explains the negative charge with alkaline powders, whilst in the case of neutral salts, the charge is dependent on the relative velocities of the two ions. The differences between the results obtained with glass and sulphur plates are due to the fact that the films on the plates themselves are respectively alkaline and acid solutions. The author further discusses the law enunciated by Ceehn that, of two dielectrics in contact, the one with the higher dielectric constant becomes positively charged (Abstr., 1898, ii, 365).

L. M. J.

**The Discharge Potential of Hydrogen at a Mercury Cathode.** By ALFRED COEHN and EDGAR NEUMANN (*Zeit. physikal. Chem.*, 1901, 39, 353—354).—The difference between the discharge potential of hydrogen at a platinum and at a mercury cathode at  $-85^{\circ}$  is nearly the same as the difference at  $18^{\circ}$ , and the authors conclude that, since in one case the mercury is solid and in the other case it is liquid, the discharge potential of hydrogen at metal cathodes is dependent, not on accidental properties of the metal, such as the form and nature of the surface, but on the chemical individuality of the metal.

J. McC.

**Potential Differences in Vapours and in some Solid Electrolytes.** By RUDOLF VON HASSLINGER (*Monatsh.*, 1901, 22, 907—916).—The author has measured the potential differences assumed by metals when placed in a bunsen burner into which solutions of various salts are sprayed. The potential difference is influenced by the basic as well as the acid constituent of the salt, but the greater part of the potential difference measured seems to be due to the latter. The most remarkable result observed was that, in the vapour of certain salts, iron and nickel assumed a positive potential towards platinum. In fused lithium chloride, iron is negative towards platinum. The difference of potential varies with the temperature, the maximum value being reached at about  $800^{\circ}$ . On further raising of the temperature, the *E.M.F.* decreases, and in lithium chloride, vapour passes through zero to the change of sign.

The same phenomenon is well-shown with the solid electrolytes, calcium and magnesium oxides.

G. Y.

**Dielectric Constant of Paraffins.** By WILL G. HORMELL (*Amer. J. Sci.*, 1901, [iv], 12, 433—446).—The paper is mainly physical. By means of an electric wave method, the author finds that the higher the melting point of the paraffin, the greater is the dielectric constant. As the wave-length diminishes, the dielectric constant increases. Cauchy's formula for calculating the index of refraction for infinitely long waves gives results inconsistent with experiment.

J. C. P.

**Electrical Properties of Alloys of Copper and Cobalt.** By G. REICHARDT (*Ann. Phys.*, 1901, [iv], 6, 832—855).—The effect of small quantities of cobalt on the electrical properties of copper is almost as great as that of manganese and about three times as great as that



of nickel. The addition of 3—5 per cent. of cobalt gives an alloy with a minimum temperature coefficient of resistance ( $+0.00077$ ), and with a maximum thermoelectric effect (against copper) of 33 microvolts for  $1^{\circ}$  temperature difference. Up to this composition, the specific resistance of the alloys increases rapidly, but further addition of cobalt produces only a slow increase of resistance. The only practical application that could be made of the alloys is in the construction of thermoelectric batteries.

The addition of small quantities of copper has a great effect on the properties of cobalt. The specific resistance has a maximum, the thermoelectric effect a minimum, value between 0 and 10 per cent. of copper. All alloys except those containing less than 1.5 per cent. of cobalt can be magnetised, the magnetism being destroyed only at a bright-red heat. It is noted that alloys of copper and nickel cannot be magnetised.

J. C. P.

**Electrical Conductivity of Flames and Gases.** By ALEXANDRE DE HEMPTINNE (*Zeit. physikal. Chem.*, 1901, 39, 345—352. Compare Abstr., 1893, ii, 563).—The deflection of a galvanometer needle contained in a battery circuit was observed when gas explosion took place in a tube containing free ends (electrodes) of the circuit. The deflection decreases with decrease of *E.M.F.* of the battery, but not exactly proportionally. It decreases as the distance between the electrodes is increased. When the electrode connected with the positive pole of the battery is large and that connected with the negative pole is small, a large deflection is obtained, whilst if the connections be reversed only a small deflection is noticed, thus indicating that the conductivity of an explosion (like that of a flame) is unipolar. The deflection is greatest when the explosion tube is open to the air, and is very small when the whole apparatus is kept at a temperature much above  $100^{\circ}$ . Practically the same results were obtained when the electrodes consisted of platinum, gold, or iron wires, and a magnetic field is also without influence. These experiments were made with an explosive mixture of hydrogen and oxygen. With a dry mixture of hydrogen and chlorine, or of oxygen and carbon monoxide, no deflection was obtained, but when the mixture was moist, the needle moved through 0.5 mm. From the experiments, it is deduced that no ions take part in the gas reaction, but the electricity is solely transported by condensed water, for conditions under which condensation may take place favour the transportation.

J. McC.

**A Peculiar Cell containing Chromic Chloride (Electrochemical Equilibrium between Different Degrees of Oxidation).** By ARRIGO MAZZUCHELLI (*Gazzetta*, 1901, 31, ii, 371—395).—In 1886, Case described a cell (*Proc. Roy. Soc.*, 1886, 40, 348) consisting of tin and platinum poles in chromic chloride solution, which he stated had an *E.M.F.* 0 at the ordinary temperature, and 0.25 volt at  $95^{\circ}$ . It was found later, however, by Skinner (Abstr., 1896, ii, 3), that this cell has the *E.M.F.* 0.44 volt at  $15^{\circ}$  and 0.40 volt at  $97^{\circ}$ , but that it polarises much more readily at low than at higher temperatures. The reactions taking place in the cell are, at high temper-

atures, the solution of tin by the liquid with the production of chromous chloride, and reprecipitation of the tin in the cold. As was shown by Case, the cell is very variable in its action; the *E.M.F.* is altered by shaking and exhibits a steady decrease when the cell is left to itself on open circuit, the fall being more rapid at high than at lower temperatures. The author explains these changes as due in the first instance to the action of the chromic chloride on tin, which takes place as a local action, even when the cell is an open circuit, producing stannous and chromous chlorides; the latter are then always present in the liquid of the cell in proportions depending on the amount of surface presented by the tin, on the time of standing, &c., and further, their distribution throughout the liquid is not uniform. The potential of the platinum is, of course, dependent on the exact composition of the liquid in contact with it. The author derives, from theoretical considerations, the action of a cell containing both oxidising and reducing compounds, and endeavours to determine chemically the equilibrium between tin and chromic, chromous, and stannous chlorides, but the numbers obtained do not agree with the theoretical values. The only interest attaching to this cell is not, as was stated by Haber ("Electrochemie," p. 177), that it allows of the direct transformation of heat into electrical energy, or, as was mentioned by Skinner, that it is capable of executing a Carnot's cycle, but that owing to the very high temperature coefficient of the reaction taking place in it, the chemical and electrical equilibria between the different states of oxidation are readily attained. T. H. P.

The Decomposition-tension of Molten Sodium Hydroxide and of Lead Chloride. By JULIUS FRIEDRICH SACHER (*Zeit. anorg. Chem.*, 1901, 28, 385—460).—When sodium hydroxide is fused in an iron vessel it soon assumes a red tinge, and when this has happened the iron has become passive so that on immersion of an iron wire into the fused mass there is no polarisation current; up to the time when this passive state has been induced, a polarisation current of very variable strength is obtained. The only metals suitable for electrodes in the electrolysis are iron and platinum, the former being preferable. The discharge potential and the cathodic and anodic decomposition-tensions of fused sodium hydroxide have been determined in an iron vessel with an iron electrode, and with a platinum vessel and electrode, at temperatures varying between 385° and 563°, and between 575° and 694°. The curve of cathodic decomposition shows two well-marked breaks, as also does that of the anodic decomposition; the values found for the points at which the curve shows a sudden change are: for the cathodic discharge, 1.16 volts (at 390°) and 2.06 volts (at 389°), and for the anodic, 0.11 volt (at 395°) and 1.31 volts (at 393°). The higher cathodic point corresponds with the separation of sodium and the lower with the separation of hydrogen. The higher anodic point is due to the discharge of hydroxyl ions and the lower to that of O' ions. This lower anodic point disappears as the hydroxide becomes free from water and the author concludes that the sodium hydroxide dissociates into Na<sup>+</sup> and OH', and the water either itself gives the ions H<sup>+</sup> and O'', or causes these to be formed from the OH'.

The polarisation of fused lead chloride was determined by the decomposition method in glass vessels of various forms, using carbon electrodes. Two breaks occur in the curves obtained; the position of the lower break varies greatly with the distance between, and the size of the surface of, the electrodes. At  $575^{\circ}$ , the higher break occurs at 1.256 volts, at  $681^{\circ}$ , it is at 1.190 volts. When the electrodes are encased, the lower break entirely disappears. This lower break is due to a depolarisation effect produced by the depolarising action of a cloud of lead vapour which diffuses from the cathode to the anode. The higher break corresponds with the reversible action:  $\text{PbCl}_2 \rightleftharpoons \text{Pb} + \text{Cl}_2$ . Similar conclusions are to be drawn from the results obtained by determining the discharge potentials.

Considerable doubt must be entertained as to the interpretation of results given by Garrard (*Zeit. Elektrochem.*, 1899, 6, 214), who assumes that the electrolytic decomposition of salts of bivalent metals takes place in two stages:  $\text{MR}_2 = \text{MR} \cdot + \text{R}'$  (corresponding with the higher break in the decomposition curve) and  $\text{MR} \cdot = \text{M} \cdot + \text{R}'$  (corresponding with the lower break).  
J. McC.

**Influence of the Addition of a Salt with one similar Ion on the E.M.F. of Electrolytic Cells.** By OTTO SACKUR (*Zeit. physikal. Chem.*, 1901, 39, 364—368. Compare Abstr., 1901, ii, 636).—Planck's formula for the influence of a salt with one similar ion on the E.M.F. of an electrolytic cell becomes identical with that of Abegg and Bose when the concentrations of the electrolyte,  $C_1$  and  $c_2$ , are the same.

It is shown that diffusion can take place against the fall of concentration, and that the ions do not only follow Dalton's law of partial pressure but their motion is influenced by osmotic and electrical forces.  
J. McC.

**Electro-chemistry of Double Salts.** By WLADIMIR A. KISTIAKOWSKY (*J. Russ. Phys. Chem. Soc.*, 1901, 33, 480—496 and 592—621).—The author indicates a new method of calculating the electrolytic potentials of the alkali and alkaline earth metals from the heats of formation of the haloid salts in dilute aqueous solution. The numbers given, which are calculated from results obtained by Thomsen and by Berthelot and refer to the potential of the hydrogen electrode in a normal solution taken as zero, differ from those of Wilmshire (Abstr., 1901, ii, 2).

The conditions of concentration and temperature necessary for the formation of the two complex salts,  $\text{Ag}_3\text{I}(\text{NO}_3)_2$  and  $\text{Ag}_2\text{INO}_3$ , have been investigated (compare Hellwig, Abstr., 1900, ii, 723). By measurements of the electromotive force of the concentration-cell,  $\text{Ag} | \text{AgNO}_3, \text{AgI} | \text{AgNO}_3 \text{ (concentrated)} | \text{AgNO}_3 | \text{Ag}$ , the author shows that the salt  $\text{Ag}_3\text{I}(\text{NO}_3)_2$  is resolved into the ions  $\text{Ag}_3\text{I}$  and  $2\text{NO}_3$ . In the case of  $\text{Ag}_2\text{INO}_3$ , the ions are probably  $\text{Ag}_2\text{I}$  and  $\text{NO}_3$ .

A relative measure of the free energy of formation of double salts of potassium cyanide with other cyanides has been obtained by determining the electromotive force of the element,  $\text{R} | \text{KCN} | \text{RX} | \text{R}$ , R being a metal and RX one of its salts. Where R represents Mg, Al, Zn, Cd, H, or Cu, it is found that the electromotive force increases as

the electro-affinity decreases, as is required by the principle put forward by Abegg and Bodländer (*Abstr.*, 1899, ii, 542). The exceptions to this rule, namely, Ni, Pb, Hg, and Ag, are due to the capacity possessed by these elements for forming complex cathions.

The author has determined experimentally the relative velocities of migration of the ions of the double salts,  $\text{Ag}_3\text{Cr}(\text{C}_2\text{O}_4)_3 \cdot 4\text{H}_2\text{O}$ ,  $\text{K}_4\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$ , and  $\text{K}_3\text{Co}(\text{CN})_6$ , the results showing that Kohlrausch's law holds for such complex salts. A sketch and description of the special apparatus employed in these measurements are given.

Measurements have also been made of the electrical conductivity of very dilute solutions of the salts,  $\text{KAg}(\text{CN})_2$ ,  $\text{K}_2\text{Ni}(\text{CN})_4$ ,  $\text{K}_3\text{Co}(\text{CN})_6$ ,  $\text{K}_3\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$ , and  $\text{K}_3\text{Cr}(\text{C}_2\text{O}_4)_3 \cdot 3\text{H}_2\text{O}$ .  
T. H. P.

**Production and Maintenance of Low Temperatures.** By ARSÈNE D'ARSONVAL (*Compt. rend.*, 1901, 133, 980—983).—Temperatures down to  $-60^\circ$  are readily obtained by means of methyl chloride contained in a porous battery cell from the walls of which the necessary evaporation takes place spontaneously. Temperatures of  $-112^\circ$  to  $-115^\circ$  are obtained by means of solid acetylene or solid carbon dioxide, the former being as manageable as the latter, whilst it evaporates more slowly and at a lower temperature,  $-85^\circ$ . Both dissolve readily in acetone and the temperatures specified are produced by the evaporation of these solutions, the air which is bubbled through the liquid being previously cooled by passing through a metal worm cooled by the gases escaping from the liquid. For temperatures below  $-115^\circ$ , liquid air must be used, and with its aid any low temperature down to  $-194^\circ$  can be obtained and kept constant. The object to be cooled is immersed in a bath of paraffin of low boiling point, the bath being cooled by allowing liquid air to drop into and evaporate from a small metal vessel placed in the paraffin at its surface. The temperature is controlled by the rate of flow of the liquid air, which can be regulated in various ways. In the cylindrical double-walled vessels with a vacuum space between and with silvered walls, the loss of liquid air at the ordinary temperature by spontaneous evaporation from a vessel of about 1000 c.c. capacity is only about 20 grams per hour.  
C. H. B.

**New Furnace Heated by the Oxyhydrogen Blowpipe.** By HENRI MOISSAN (*Ann. Chim. Phys.*, 1901, 24, [vii], 289—298).—This furnace consists of a cylindrical box of hydraulic lime, perforated concentrically through its cover and bottom. The oxyhydrogen blowpipe is introduced into the lower aperture and the products of combustion escape by the hole in the cover. The crucible is made of quicklime, or of graphite with a protective outer coating of quicklime and is supported on three quicklime prisms placed on the floor of the furnace. This apparatus is employed in melting refractory substances and differs from the furnace devised by Deville and Debray in being heated from below instead of from above. As the flame does not come into contact with the contents of the crucible, the furnace may be used for fusing oxidisable substances.  
G. T. M.

[**Thermodynamics of Concentrated Solutions.**] By J. J. VAN LAAR (*Zeit. physikal. Chem.*, 1901, 39, 342—344).—The author



considers that the deductions made by Schükareff (this vol., ii, 4) are founded on false premises and are quite worthless. Thus he assumes that  $\mu_1$  is only a function of  $m_1$ , and  $\mu_2$  is only a function of  $m_2$ , whereas it is well known that  $\mu_1$  and  $\mu_2$  are very complicated functions of  $T$ ,  $p$ ,  $m_1$ , and  $m_2$ , and known only for some few simple cases. Further, there can be no distinction between "determinate" and "undeterminate" potential as supposed by Schükareff. J. McC.

**Heat of Formation of Chlorine Hydrate.** By ROBERT DE FORCRAND (*Compt. rend.*, 1901, 133, 1304—1306).—Direct determinations of the heat of dissolution of chlorine hydrate, corrected for the uncombined water present, and the quantity of chlorine that it holds in solution, gave  $-15\cdot63$  Cal. as the mean of three experiments, and hence  $\text{Cl}_2$  gas +  $n\text{H}_2\text{O}$  liq. =  $\text{Cl}_2$ ,  $n\text{H}_2\text{O}$ , sol. develops  $+18\cdot57$  Cal. The value of the heat of formation, calculated from the curves of dissociation representing the observations of Isambert, Roozeboom, and Le Chatelier respectively, is  $+18\cdot16$  Cal. C. H. B.

**Investigations with the Micromanometer.** By A. SMITS (*Proc. K. Akad. Wetensch. Amsterdam*, 1901, 4, 163—169. Compare Abstr., 1900, ii, 388, 389, 708; 1901, ii, 304, 436).—With a slightly modified form of his manometer, the author has determined the decrease of vapour tension for solutions of sodium chloride, sulphuric acid, and potassium nitrate. In the first two cases, a minimum value of  $i$  is found near the concentrations  $0\cdot45$  gram-mol. and  $0\cdot1$  gram-mol. per 1000 grams of water respectively. With potassium nitrate, on the other hand, there is a regular decrease in the value of  $i$  up to the most concentrated solution investigated  $-0\cdot93$  gram-mol. per 1000 grams of water. These results are in qualitative agreement with those obtained by the boiling point method. The author thinks that the existence of a minimum value of  $i$  for sodium chloride will be satisfactorily proved by the freezing point method also, although this is not the case as yet (see Raoult, Abstr., 1899, ii, 203; Chroustchoff, Abstr., 1900, ii, 86; Kahlenberg, Abstr., 1900, ii, 540). In reference to Kahlenberg's recent paper (*loc. cit.*), the author, whilst admitting that the values of  $i$  deduced from the conductivity differ in general from those obtained by a non-electrical method, does not regard this as sufficient ground for rejecting Arrhenius' theory. It is probable that the conductivity is a correct measure of the dissociation, and that the different values given by other methods are due to the simultaneous occurrence (in moderately concentrated solutions) of ions and the products of polymerisation or association. J. C. P.

**Polymerisation of Inorganic Chloro-anhydrides.** By GIACOMO L. CIAMICIAN (*Atti Real. Accad. Lincei*, 1901, [v], 10, ii, 221—226).—The fact that the molecular weights obtained from ebullioscopic measurements of certain inorganic chloro-anhydrides seem to indicate polymerisation of these compounds has been explained by Oddo (this vol., ii, 6) as due to the volatility of the dissolved substances at the temperature of the boiling solution. On determining the value of the ratio,  $\alpha$ , of the concentrations of phosphorus oxychloride in the

vapour given off from a benzene solution and in the solution itself, and allowing for the volatilisation by multiplying the observed molecular weight by  $(1 - a)$ , Oddo (*loc. cit.*) found that the numbers obtained still exceeded the true molecular weight. On repeating these experiments, however, the author finds for  $a$  a mean value of 0.515, Oddo's numbers being 0.27, 0.31, and 0.27; correcting by means of the value 0.515, the experimental molecular weights agree well with the normal value.

T. H. P.

**New Methods for the Determination of Molecular Weights of Substances in Dilute Solution.** By GIOVANNI GUGLIELMO (*Atti Real. Accad. Lincei*, 1901, [v], 10, ii, 232—239).—All those methods used in hygrometry to determine the tension of the aqueous vapour of the air and the relation between this tension and that of saturated water vapour at the same temperature may be employed to measure the tensions of vapours in contact with (1) a solution, and (2) the pure solvent, and from these the molecular weight of the dissolved substance can be deduced. The author describes in detail three different methods of working, in all of which very simple apparatus is made use of. (1) In the first method, a layer about 1 cm. deep of the solution is placed in a small flask furnished with a stopper containing three holes, through two of which pass thermometers reaching to within 1 cm. of the surface of the liquid, the bulb of one being surrounded by two or three thicknesses of filter paper fastened to the thermometer; through the third hole passes a rod for stirring the liquid. When the solution is in the flask, the stopper is raised for a moment, and by means of a pipette the covered thermometer bulb is thoroughly moistened with the solvent; the stopper being replaced, the temperatures indicated by the two thermometers soon become constant and are read off. The molecular weight of the solute is given by the formula  $M = C.p/(t - t_1)$ ,  $p$  being the weight of the dissolved substance per 100 parts of the solvent,  $t$  and  $t_1$  the temperatures of the dry and wet thermometer bulbs respectively, and  $C$  a constant depending on the vapour pressure of the solvent, on the atmospheric pressure, and on the change of the latter per  $1^\circ$ ;  $C$  may be calculated from these magnitudes, but it is preferable to determine it experimentally by measurements made on a solution of a compound of known molecular weight. (2) In this method, no thermometer is needed, as the rate of evaporation, and hence the rate of cooling, of a rod or tube surrounded at its lower part by filter paper and moistened with the solvent, is measured by its loss in weight in a certain time when placed in the flask employed in the previous method. (3) The third method makes use of a wide-mouthed flask containing a little of the solution and fitted with a perforated stopper which carries a wide, nickelled tube, closed at the bottom and containing a little of the solvent; the top of this tube is closed by a treble-bored stopper, through which pass a thermometer and a tube drawn out to a fine point at the bottom, both dipping in the liquid, and another shorter tube open at both ends. Air is caused to bubble through the solvent by means of the drawn-out tube, the evaporation thus produced serving to cool the nickelled tube, which acts as the essential part of a Regnault's hygrometer.

The practical details and precautions to be attended to in the working of these three methods are given. T. H. P.

**Volume and Density Changes in Liquids due to the Absorption of Gases.** By E. WENZEL (*Ann. Phys.*, 1901, [iv], 6, 520—532).—A form of dilatometer is described by which the changes referred to can be accurately determined. The liquid used in the investigation was water, and the gases absorbed were hydrogen, oxygen, carbon dioxide, sulphur dioxide, and ammonia. Following Ångström (*Abstr.*, 1882, 687; 1888, 401), and defining the absorption-dilatation coefficient ( $\delta$ ) as the relative increase of volume of the liquid caused by absorption of 1 c.c. of gas at 0° and 760 mm. pressure, the author finds that, in the case of hydrogen and oxygen, the values of  $\delta$  are nearly independent of the quantity of gas absorbed; in the case of carbon dioxide, the value of  $\delta$  diminishes at first, then becomes constant, and finally, when the water is nearly saturated with the gas, rises slightly. For sulphur dioxide, there is a steady rise, for ammonia a steady fall, in the value of  $\delta$ . The law, therefore, according to which the increase of volume is proportional to the quantity of gas absorbed, holds only for gases which are but slightly soluble. The specific gravities of the dissolved gases have been calculated with the help of  $\delta$ ; the values thus calculated are in each case much greater than the specific gravities of the liquefied gases.

J. C. P.

**A New Method for the Determination of the Surface Tension of Liquids.** By WILLIAM HENRY WHATMOUGH (*Zeit. physikal. Chem.*, 1901, 39, 129—193).—The method consists essentially in the determination of the pressure necessary for the formation of bubbles at the end of a capillary tube dipping into the liquid, the value being compared with that required with the same capillary in a liquid of known surface tension. The precautions necessary to ensure accuracy are investigated, and the results show that when these are observed the method is both speedy and accurate. In salt solutions, the surface tension is a linear function of the concentration, and the author finds that an equal increase of surface tension is produced by equivalent weights of chlorides of lithium, sodium, potassium, barium, strontium, and magnesium; the effect of ammonium chloride was, however, slightly less, whilst that of calcium chloride was greater. The effect of sulphates is less than that of chlorides, and the effect of nitrates slightly lower than that of sulphates. The author does not find that keeping for 24 hours produces any alteration of surface tension of a solution, a result not in accord with the early observations of Quincke (*Ann. Phys. Chem.*, 1877, 160, 337). A number of binary mixtures were examined and may be divided into classes. (1) Mixtures in which the surface tension could be directly calculated from the surface tensions of the components, as in the case of chloroform and ethyl ether, benzene and toluene. (2) Mixtures for which the surface tension is throughout less than the calculated value, as for water and acetic acid, ethyl ether and benzene, &c. (3) Mixtures in which a minimum value is attained, as in the cases of toluene and xylene, acetic acid and benzene, and others. (4) Mixtures in which a maximum value is found; the

only mixture of this class examined was that of sulphuric acid and water, the maximum being reached when the mixture contains 46 per cent. of the acid, and it is noteworthy that the compressibility reaches a minimum at the same composition. A number of liquid mixtures which form two phases were also examined, and, as expected, the differences in the surface tensions of the two phases decreased with rise of temperature, becoming *nil* at the critical point. Solutions of two salts gave results in accord with those calculated additively. Some ternary mixtures were examined, and curves are given representing the results.

L. M. J.

**Number of Ions in Metallo-ammonium Compounds.** By EMIL PETERSEN (*Zeit. physikal. Chem.*, 1901, 39, 249—252).—A reply to Werner's criticisms on the author's work (*Abstr.*, 1901, ii, 638).

L. M. J.

**Solvent and Dissociative Powers of Liquid Cyanogen and Liquid Hydrogen Cyanide.** By M. CENTNERSZWER (*Zeit. physikal. Chem.*, 1901, 39, 217—224, and *J. Russ. Phys. Chem. Soc.*, 1901, 33, 545—547, 547—549).—Liquid cyanogen has but slight solvent power, and it is shown that its dissociative power is likewise very small. Experiments with liquid hydrogen cyanide showed, however, that the salts examined (potassium iodide and trimethylsulphine iodide) were far more highly dissociated in this solvent than in water, a result in accord with the Nernst-Thompson rule connecting the dissociative power and the dielectric constant (compare Schlundt, *Abstr.*, 1901, ii, 299).

L. M. J.

**Boundaries between Polymorphism and Isomerism.** By RUDOLF WEGSCHEIDER (*Monatsh.*, 1901, 22, 917—938).—The theoretical distinction between polymorphism and isomerism is held to be useful in spite of the vagueness of the dividing line. Polymorphism may occur along with polymerism as well as with isomerism.

A detailed discussion of the criteria by which these may be distinguished leads to the conclusion that, whereas isomerism may be sharply characterised, it is not possible to determine the presence of polymerism to the complete exclusion of isomerism (compare Schaum, *Abstr.*, 1898, ii, 372; Bancroft, *Abstr.*, 1899, ii, 145).

G. Y.

**Velocity of Reaction in Organic Solvents. Decomposition of Chloro- and Bromo-acetic Acids by various Bases in Solution in different Alcohols.** By A. SCHWEINBERGER (*Gazzetta*, 1901, 31, ii, 321—333).—The following table gives the mean values of *K* for the hydrolysis by means of different bases of bromoacetic acid dissolved in various alcohols and in water, the temperature in each case being 60°.

It will be seen that methyl alcohol acts irregularly, since in some cases it gives a quicker, and in others a slower, reaction than is obtained with ethyl alcohol. Further, in ethyl alcoholic solution, sodium methoxide has a less rapid hydrolysing action than the ethoxide, whilst from a consideration of the dissociation in the two cases, the contrary would be expected. This anomalous behaviour of methyl



Base	Water.	Alcohols.		
		Ethyl.	Methyl.	Propyl.
Sodium hydroxide.....	0.82	0.75	0.54	—
Potassium „.....	0.98	0.70	0.596	—
Sodium methoxide.....	—	0.32	0.59	1.7
Sodium ethoxide .....	—	0.37	0.54	—
Sodium propoxide.....	—	0.55	0.39	—
Ammonia .....	2.3	0.75	0.326	—

alcohol has been noticed in other reactions by various observers, and may be explained as due to some kind of chemical action taking place between the solvent and the solute, and influencing the general relations of the solvent as predicted from its physical properties.

T. H. P.

**Law of the Action of Invertase.** By VICTOR HENRI (*Zeit. physikal. Chem.*, 1901, 39, 194—216; *Compt. rend.*, 1901, 133, 891—894).—The velocity of inversion of sucrose by invertase is not represented by the equation  $dx/dt = k(a - x)$  leading to  $k = 1/t[\log a/(a - x)]$ , but the author shows that the reaction velocity may be expressed by  $dx/dt = k_1(1 + x/a)(a - x)$  or  $2k_1 = 1/t[\log(a + x)/(a - x)]$ . Experiments were also made in which, after various intervals of time, additional quantities of sucrose were added to the solution undergoing inversion by diastase, and it was found that time had no effect on the activity of diastase, the velocity depending only on the concentrations of  $a$  and  $x$ . The value of  $k_1$  varies with the initial concentration, but the value  $ka$ , is not constant; it increases with  $a$  at low concentrations, attaining a maximum at from 0.1  $N$  to 0.4  $N$  solutions (*Abstr.*, 1901, i, 438; ii, 647).

L. M. J.

**Pseudocatalytic carrying of Oxygen.** By CARL ENGLER and LOTHAR WÖHLER (*Zeit. anorg. Chem.*, 1901, 29, 1—21. Compare *Abstr.*, 1897, ii, 402; 1899, i, 189, 221; 1900, i, 399; 1901, i, 657).—Pseudocatalysis (Wagner, *Abstr.*, 1899, ii, 275), in which oxidation takes place, can be divided into three categories where the oxygen carrier is (1) a noble metal or its easily reducible oxide, (2) an oxide or salt of an element the valency of which varies, (3) an animal or plant oxidation-ferment.

The results of Mond, Ramsay, and Shields (*Abstr.*, 1895, ii, 492; 1898, ii, 599) on the occlusion of oxygen by platinum black have been confirmed and the following facts also observed. Platinum black turns potassium iodide starch solution blue; it is somewhat soluble in dilute hydrochloric acid, the weight of platinum in solution is less than the weight of platinum black dissolved, and if the difference be attributed to oxygen it is found that the ratio of platinum to oxygen agrees well with  $PtO$ ; the amount of oxide present in the platinum sponge depends on the state of division. It does not easily amalgamate,

and the amalgam formed becomes covered with a film of the black oxide; hydrogen peroxide does not reduce it in the cold, but on boiling, complete reduction takes place, and it is also reduced by alcohol, ether, and other organic substances; in absence of air, it oxidises arsenious to arsenic acid, and the residue loses its spongy character and becomes granular. It is further shown that the properties of active platinum sponge closely resemble those of platinous oxide, in confirmation of the theory of de la Rive that in the catalysis by platinum black, the intermediate active agent is this oxide. However, platinum sponge free from oxide causes more active oxidation than does platinous oxide, and this is explained by the Engler-Wild theory (Abstr., 1897, ii, 402) of the intermediate formation of peroxide and secondary formation of oxide, which takes place more readily with the finely divided sponge than with the more compact platinous oxide.

In like manner, the authors attribute the solution of gold in potassium cyanide in presence of oxygen to the formation of gold peroxide, which dissolves as expressed by the equation  $\text{Au}_2\text{O}_2 + 4\text{KCN} = 2\text{KAu}(\text{CN})_2 + \text{K}_2\text{O}_2$ .

Pseudocatalysis by means of oxides or salts of chromium, iron, cobalt, nickel, copper, mercury, and, in a less degree, by those of titanium, zirconium, cerium, thorium, tin, and molybdenum, and even by the non-metals phosphorus and carbon, is also explained by the intermediate formation of peroxide.

Catalysis in the plant and animal world is also due to formation of peroxides, and analogies are drawn between the oxidation-ferments and platinum sponge. J. McC.

**The Solution Theory of Dyeing.** By REGINALD B. BROWN and JOHN McCRAE (*J. Soc. Chem. Ind.*, 1901, 20, 1092—1093. Compare Abstr., 1901, i, 99; *Trans.*, 1896, 1334; *J. Soc. Chem. Ind.*, 1901, 20, 226).—The authors conclude from their experiments that within wide limits of concentration a constant percentage of dye is taken up by wool, when the relative amounts of wool and water, the temperature, and the duration of the experiment are constant. The authors favour the view that in certain cases the operation of dyeing consists simply in the formation of a solid solution, and to this solution Henry's law is strictly applicable, but at the same time they recognise that this does not hold good in general, for the non-reversibility of the process in most cases favours the view that a chemical or physical change takes place during the fixing. H. R. LE S.

**Colloids.** By GRÉGOIRE WYROUBOFF (*Bull. Soc. Chim.*, 1901, [iii], 25, 1016—1022).—A controversial paper, not suitable for abstraction. T. M. L.

**Origin of the Elements. Some Stereochemical Views on the Question of the Unity of Matter.** By PAUL HELLSTRÖM (*Zeit. anorg. Chem.*, 1901, 29, 95—106).—The author believes that the elements have been formed from a primordial matter, the differences between them being due to the different polyhedral forms into which it has aggregated. He explains valency as due to attractions in particular directions in the aggregated mass. The periodicity of the properties of the elements leads to the conclusion that one series occurs in each of

the seven holohedral forms of the regular crystallographic system. The elements of the eighth series have a form with varying parametral ratio.  
J. McC.

**The Periodic System of the Elements.** By H. STAIGMÜLLER (*Zeit. physikal. Chem.*, 1901, 39, 245—248).—Another variation of the classification of the elements for which the author claims that the elements fall into more natural groups, and that the non-metals become separated from the metals.  
L. M. J.

**Third Report of the Committee [of the German Chemical Society] on Atomic Weights.** By the Members of the Committee: HANS LANDOLT, WILHELM OSTWALD, and KARL SEUBERT (*Ber.*, 1901, 34, 4353—4384. Compare *Abstr.*, 1899, ii, 86; 1900, ii, 533).—Further inquiry has been made by the Committee in order to discover the views of chemists on the question whether the basis of atomic weights shall be taken as  $H=1$  or  $O=16.00$ . Of the total number of answers received, 106 were in favour of  $H=1$  and 78 in favour of  $O=16.00$ .

Since the last report, the Committee have recommended that the atomic weight of iron be changed from 56 to 55.9, and that of calcium from 40 to 40.1.  
K. J. P. O.

**Theory of Unsaturated Compounds.** By F. WILLY HINRICHSSEN (*Zeit. physikal. Chem.*, 1901, 39, 304—310).—The assumption is made that atoms have an invariable affinity or saturation capacity, and reasons must be sought in order to explain why this does not reach its maximum in certain cases. Temperature is one cause, as van't Hoff (*Ansichten ueber organische Chemie*) has shown, and another cause is the electrochemical character of the components. Blomstrand (*Chemie der Jetztzeit*) points out that when a strongly positive or negative element acts with its full positive or negative force, it is always found in its lowest degree of saturation; thus, when the halogens form salts, that is, act decidedly negatively, they are always univalent. Blomstrand further points out that the energy content of an atom is the greater, the fewer affinity units come into play.

The author believes that all cases of unsaturated compounds are to be explained by assuming that the valency is constant, but part of the affinity, from one or both of the above causes, remains in abeyance.

Baeyer's tension theory, and Thiele's theory of partial valency, do not agree with the behaviour of many organic compounds, and there is now no reason to believe that carbon may not occur with free valencies, as in carbon monoxide ( $C:O$ ), hydrocyanic acid ( $C:NH$ ), isonitriles ( $C:NR$ ), and fulminic acid ( $C:N\cdot OH$ ).

The explosive nature of acetylene ( $:CH\cdot CH:$ ) is explained by the great content of energy of the bivalent carbon which it contains, according to Blomstrand's hypothesis. The 1:4 rule for the formation of additive compounds can also be explained by the assumption of free valencies.  
J. McC.

**Simple Lecture Experiments to Demonstrate the Dissociation, on Heating, of the Chloride and other Salts of Ammonium.** By DIOSCORIDE VITALI (*L'Orosi*, 1901, 24, 332—334).—The dissociation of ammonium chloride may be shown by heating it

in presence of a small quantity of a mixture of potassium iodide and iodate; the hydrogen chloride evolved acts on these two salts, forming hydriodic and iodic acids, which react to yield iodine, the latter then volatilising as a violet vapour. The ammonia also formed in this reaction may be detected, not only by its odour, but also by its action on turmeric paper and by the white fumes formed in presence of a rod moistened with hydrochloric acid. Also, in solution, iodine is obtained by heating ammonium chloride or sulphate in presence of potassium iodide and iodate. Instead of the iodine salts, a mixture of potassium bromide and bromate, or of chloride and chlorate, may be employed.

T. H. P.

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## Inorganic Chemistry.

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**Reaction between Nitric Acid and Hydrogen Iodide.** By ADOLF ECKSTÄDT (*Zeit. anorg. Chem.*, 1901, 29, 51—94).—So long as air is free from dust, it has no influence on the action between nitric and hydriodic acids. Scratches on the flask in which the reaction takes place accelerate the reaction to an enormous extent. The order of the reaction between nitrous acid and hydriodic acid could not be determined; the reaction takes place very rapidly at first, but soon slackens. Reaction takes place directly ( $\text{NO}_3' + 2\text{H}\cdot + 2\text{I}' = \text{NO}_2' + \text{H}_2\text{O} + \text{I}_2$ ) between nitric acid and hydriodic acid, for when carbamide is added in order to destroy any nitrous acid present, the action has a normal course. Hydrogen ions exert a catalytical influence on the reaction.

Ferric ions, as well as sixteen other cations examined, have no catalytic influence whatever on the reaction. Ferrous ions enormously accelerate the reaction, the influence being independent of the anion present.

It was observed that when about two-thirds of the hydriodic acid had been decomposed, a great acceleration took place, so that the reaction thereafter quickly completed itself, and this is attributed to the influence of the iodine produced. Tri-iodine ions can only be formed so long as iodine ions are present, that is, until about two-thirds of the hydriodic acid is used up. Then the action of the oxidiser ceases, or iodine is separated in the colloidal state or as a solid, and this, giving rise to new iodine ions, restarts the reaction, which proceeds until it is complete.

When the reaction takes place in an electric field, no difference in the rate could be detected.

J. McC.

**Spontaneous Decomposition of Ozone.** By EMIL WARBURG (*Sitzungsber. K. Acad. Wiss. Berlin*, 1901, 48, 1126—1139).—The spontaneous decomposition of ozone, where external causes of decomposition are excluded, is a bimolecular reaction. At the ordinary temperature, the results obtained indicate that the decomposition takes place in



accordance with the formula for a monomolecular reaction, but this is attributed to the disturbing influence of the glass walls of the containing vessel. The influence of external agents on the speed of decomposition increases much more slowly with rising temperature than does the actual velocity of the bimolecular reaction. The quantity,  $b$ , of ozone which is decomposed per minute can be ascertained from  $dC = -bC^2dt$ , where  $C$  is the number of gram-mols. of ozone per litre and  $t$  is the time. The value of  $b$  at  $100^\circ$  is  $0.0157$ , and at  $126.9^\circ$  it is  $0.177$ . The velocity quotient for  $10^\circ$  is  $2.47$ . Shenstone (*Trans.*, 1897, 71, 477) states that at  $26^\circ$  moist ozone is more stable than dry; the author finds that, at  $100^\circ$ , the dry gas is just as stable as the moist.

J. McC.

**Sublimed Sulphur.** By NORMAN LEONARD (*Analyst*, 1901, 26, 319—320).—Although sublimed sulphur B.P. is not supposed to affect blue litmus, the author has found it generally to contain from  $0.02$  to  $0.25$  per cent. of sulphuric acid. Although part of the acid may be formed during the process of sublimation, it is also formed by exposure to air and moisture. A sample of sublimed sulphur, after being washed until no longer acid, was put in a moist condition into a stoppered bottle; after two weeks, it was found to be faintly acid, and decidedly so after three months, whilst after four years it contained  $0.2$  per cent. of sulphuric acid; sulphurous acid could not be detected. A specimen which had been washed, and dried at  $100^\circ$ , only showed  $0.0025$  per cent. of acid after having been kept for four years.

L. DE K.

**Viscosity of Sulphur.** By CH. MALUS (*Ann. Chim. Phys.*, 1901, 24, [vii], 491—574).—Sulphur, when heated for 5—10 minutes at  $357^\circ$ , is black and on cooling to  $100^\circ$  becomes pale yellow. The modification of the element produced in this way is indicated by the symbol  $S_1$ ; it is viscous at  $100^\circ$  and contains bubbles of sulphur dioxide; at  $15^\circ$ , it becomes plastic (compare *Abstr.*, 1900, ii, 536). Another modification,  $S_2$ , is produced when the heating at  $357^\circ$  is prolonged for 3 hours; this form is lighter in colour than  $S_1$ , being almost colourless at  $73^\circ$ ; it is not viscous at  $100^\circ$ , and contains no gaseous bubbles at this temperature, and at the ordinary temperature it becomes quite hard. Sulphur heated at  $300^\circ$ , or at higher temperatures, passes ultimately into the modification  $S_2$ , the rate of change depending on the temperature; complete transformation requires 30 hours at  $300^\circ$  but only 15 minutes at  $440^\circ$ . The modification  $S_1$  owes its existence to the presence of sulphur dioxide in the sulphur and its conversion into  $S_2$  is due to the expulsion of the gas; any causes which tend to eliminate the gas more rapidly, such as the introduction of thin glass rods or the passage of carbon dioxide, increase the velocity of transformation. Moreover,  $S_2$  is reconverted into  $S_1$  when heated at  $357^\circ$  in the presence of sulphur dioxide. On the other hand, the variety  $S_1$  does not change into  $S_2$  on prolonged heating at this temperature if it is kept saturated with sulphur dioxide.

Sulphur in form of  $S_1$  is slowly converted into a third modification  $S_2'$  when maintained in superfused condition at temperatures varying from  $72^\circ$  to  $103^\circ$ ; this third variety differs from  $S_2$  in becoming viscous when heated at  $180^\circ$  or at higher temperatures. This difference is

due to the fact that, in the transformation of  $S_1$  into  $S_2'$ , there is no elimination of sulphur dioxide and therefore the latter modification still contains the dissolved gas which at higher temperatures promotes the formation of the  $S_1$  variety.

G. T. M.

**Determination of the Vapour Density of Sulphur by the Dumas Method.** By HEINRICH BILTZ and GERHARD PREUNER (*Zeit. physikal. Chem.*, 1901, 39, 323—341).—A full account of the apparatus used in determining the vapour density of sulphur at  $448^\circ$  under varying pressures. The conclusions are to be found in Abstr., 1901, ii, 649. As the quaternary reaction  $S_8 \rightleftharpoons 4S_2$  is improbable, the authors believe that the dissociation may take place in the two stages:  $S_8 \rightleftharpoons 2S_4$  and  $S_4 \rightleftharpoons 2S_2$ .

J. McC.

**Apparatus for Experimenting with Sulphur Trioxide.** By HERMANN WICHELHAUS (*Ber.*, 1901, 34, 4135).—A test-tube widened at the open end fits concentrically into a cylindrical glass receiver into which sulphur trioxide is distilled. The test-tube is filled with fragments of ice and the trioxide condenses on its cooled outer surface. When sufficient of the compound has been collected, the tube is withdrawn and another placed in position. In this way, samples of sulphur trioxide available for lecture experiments are readily obtained.

G. T. M.

**Sulphuric Acid and its Manufacture by the Contact Process.** By RUDOLF KNIETSCH (*Ber.*, 1901, 34, 4069—4115).—An account of the historical development and recent introduction on a large scale of the contact process of making sulphuric acid.

When the gases obtained by roasting pyrites are freed from mechanical impurities, and passed in a dry state through tubes containing a catalytic agent (for example, platinised asbestos), a practically quantitative yield of sulphur trioxide can be obtained at first, but the activity of the contact substance, and, consequently, the yield of sulphur trioxide, gradually diminish. It is found that certain substances, notably arsenic, mercury, and phosphorus, have a remarkably deleterious effect on the catalytic action of platinum, and the above-mentioned deterioration of the contact substance is due to the presence of arsenic in the pyrites gases. It is exceedingly difficult to get rid of the last traces of arsenic. Thus troublesome fogs of finely divided unburnt sulphur particles, containing arsenic and almost unprecipitable, are produced in the pyrites ovens, and the only remedy is to blow in steam, thus securing thorough mixture of the pyrites gases and complete combustion of the sulphur. Finally, by cooling and washing the gases in a very thorough manner, it has been found possible to free them from all hurtful impurities, and to preserve the contact substance in excellent condition.

The tubes containing the contact substance should be heated previous to the passing of the pyrites gases, but, the process having been started, very little external heat is necessary, since the heat of the reaction,  $2SO_2 + O_2 = 2SO_3$ , is very considerable, and the temperature must not be allowed to rise too high. In the apparatus described in

the paper, it was found necessary actually to cool the tubes by a current of cold air in order to procure the best results. In this contact process, the gases are not under pressure: indeed, the yield is not appreciably affected by diluting the pyrites gases largely with air.

The sulphur trioxide produced can be instantaneously and completely absorbed by sulphuric acid of 97—99 per cent., a behaviour shown by sulphuric acid of no other concentration. Acid of this "critical" concentration is peculiar in other respects also, as the author shows by a study of the boiling point curve, the sp. gr., the electrical resistance, and the action on cast and wrought iron. The gas issuing from the contact tubes can be completely freed from sulphur trioxide in a single apparatus, provided the acid in this apparatus is kept of the proper strength by regular addition of water or dilute acid, and removal of the excess of acid formed by the absorption.

The contact process does not give a quantitative yield when the sulphur dioxide and oxygen are mixed in the proportion required by the equation:  $2\text{SO}_2 + \text{O}_2 = 2\text{SO}_3$ ; the more oxygen there is in proportion to the sulphur dioxide, the more productive is the process; nitrogen is without effect on the reaction. When the pyrites gases, which contain sulphur dioxide and oxygen approximately in the ratio  $2\text{SO}_2 : 3\text{O}_2$  and in addition 83 per cent. of nitrogen, are passed over platinised asbestos in a porcelain tube, and the temperature of the tube is varied, it is found that at 400—430° 98—99 per cent. of the sulphur dioxide is converted into sulphur trioxide, whilst further rise of temperature has a bad effect on the yield; thus, at 700—750°, the yield is only 60 per cent., and at 900—1000° there is practically no reaction at all between sulphur dioxide and oxygen. In the absence of contact substance, however, sulphur trioxide is stable even at high temperatures. The formation of trioxide from dioxide and oxygen depends, too, on the rate at which the gases are passed over the contact substance, and for each temperature there is a certain rate which gives the maximum yield. Platinum alone fulfils the conditions necessary for an effective contact substance.

The paper contains also a detailed study of the physical properties of mixtures of water and sulphur trioxide in varying proportions. The melting point curve shows maxima for mixtures of the composition  $2\text{H}_2\text{O} + \text{SO}_3$ ,  $\text{H}_2\text{O} + \text{SO}_3$ ,  $\text{H}_2\text{O} + 2\text{SO}_3$ , the melting points of these three being respectively 8°, 10°, and 36°. When density is plotted against percentage composition, the resulting curve shows two maxima, one at 79.72 per cent.  $\text{SO}_3$  (= 97.66 per cent.  $\text{H}_2\text{SO}_4$ ) and the other at 92.65 per cent.  $\text{SO}_3$ , the corresponding densities being 1.8434 and 2.020 at 15°; the density of sulphur trioxide is 1.984 at 15° and 1.814 at 45°. The specific heat falls with increasing percentage of the trioxide to the value 0.339 for an acid containing about 20 per cent. of the free anhydride; the specific heat of absolute sulphur trioxide is 0.770. The heat of solution varies in a perfectly continuous manner with the percentage, and it therefore appears that the formation of the various hydrates is not accompanied by any appreciable heat effect. The observations made on the electrical resistance agree with those of Kohlrausch (*Ann. Phys. Chem.*, 1882, [ii], 17, 69), except that the

author finds a maximum value of the resistance at 99.9—99.95 per cent.  $\text{H}_2\text{SO}_4$  instead of at 99.74—99.75. With acids containing more trioxide, there is first a fall of resistance, and finally a steady increase to very high values. The boiling point curve shows a maximum, and the vapour pressure curve a minimum for the composition 80.4 per cent.  $\text{SO}_3$  (=98.5 per cent.  $\text{H}_2\text{SO}_4$ ). By allowing equal volumes of acid of varying concentration to flow through a narrow opening, it is found that water and absolute sulphur trioxide have approximately the same viscosity; the maximum viscosity corresponds with the point of maximum density for the fuming acid. The height reached in a capillary tube gradually diminishes with increasing percentage of trioxide, although there are slight peculiarities in the curve at the hydrate  $\text{H}_2\text{SO}_4 + \text{H}_2\text{O}$ , and at the point of maximum density. Finally, a table is appended for converting the percentages of total  $\text{SO}_3$ , found by analysis of the fuming acid, into percentages of free  $\text{SO}_3$ .

J. C. P.

**Allotropy of Tellurium.** By DMITRI BELJANKIN (*J. Russ. Phys. Chem. Soc.*, 1901, 33, 670—676).—The variation in the values given for the specific heats of amorphous tellurium is explained by the author as due to the fact that the modification obtained by Berthelot by precipitation from alkaline solution and described by him as amorphous, consists in reality of microscopic rhombohedra. For the densities of various modifications of tellurium at 18—22°, the author obtains the following numbers: (1) Amorphous tellurium (precipitated from acid solution by means of sulphur dioxide),  $6.015 \pm 0.031$ . (2) Ordinary crystalline tellurium,  $6.338 \pm 0.025$ . (3) Berthelot's crystalline tellurium (obtained from alkaline solution),  $6.157 \pm 0.035$ . By slowly heating to 430°, the density of (2) is unchanged, but (1) increases and (3) decreases in density; these alterations point to the existence of a third crystalline form of tellurium, which has not, however, been isolated.

Other unknown modifications are also indicated by results obtained by Berthelot (Abstr., 1887, 761) and by Töpler (Abstr., 1895, ii, 5).

T. H. P.

**Telluric Acid.** By ALEXANDER GUTBIER (*Zeit. anorg. Chem.*, 1901, 29, 22—35. Compare Abstr., 1901, ii, 501).—Telluric acid has been prepared by the method devised by Staudenmaier. No evidence could be found of the existence of an acid of the formula  $\text{H}_2\text{TeO}_4$ . The acid when heated at 145° loses water and at the same time oxygen, and in the residue both the oxides  $\text{TeO}_3$  and  $\text{TeO}_2$  are to be found. Telluric acid is dimorphous, crystallising in regular and hexagonal-rhombohedral forms, the latter being the more common.

The determination of the molecular conductivity shows that the acid is only very slightly dissociated and this is confirmed by the depression of the freezing point of water. The equivalent conductivity of the normal potassium salt differs greatly from that of potassium sulphate, but agrees well with that of potassium carbonate.

The formula of telluric acid is, as previously stated (*loc. cit.*),  $\text{H}_6\text{TeO}_6$ , and not  $\text{H}_2\text{TeO}_4 + 2\text{H}_2\text{O}$ .

J. McC.



**Some Physical Properties of Nitric Acid Solutions.** By VICTOR H. VELEY and J. J. MANLEY (*Proc. Roy. Soc.*, 1901, 69, 86—119).—Details are given of work already reviewed (*Abstr.*, 1901, ii, 447), dealing with the densities and refractive indices of nitric acid solutions. The maximum refractive index observed ( $1.4061$  at  $14.2^\circ$ ) is that of a solution containing 70 per cent. of nitric acid; the refractive index of the anhydrous acid is nearly the same as that of a solution containing equal parts by weight of acid and water. The possible errors involved in the various physical measurements are discussed and estimated.

J. C. P.

**Action of Hydrogen Sulphide on Arsenic Acid.** By LE ROY W. McCAY (*Zeit. anorg. Chem.*, 1901, 29, 36—50. Compare *Abstr.*, 1889, 15; 1898, ii, 139; 1899, ii, 745).—Monothioxyarsenic acid is formed when hydrogen sulphide acts on arsenic acid solution ( $\text{H}_3\text{AsO}_4 + \text{H}_2\text{S} = \text{H}_3\text{AsO}_3\text{S} + \text{H}_2\text{O}$ ). Dithioxyarsenic acid is also obtained but is not a direct product of the reaction; it is probably formed from the monothioxyarsenic acid ( $\text{H}_3\text{AsO}_3\text{S} + \text{H}_2\text{S} = \text{H}_3\text{AsO}_2\text{S}_2 + \text{H}_2\text{O}$ ).

Magnesium oxide is a good reagent for the separation of arsenic acid from monothioxyarsenic acid, for whilst the magnesium arsenate is insoluble, magnesium monothioxyarsenate is easily soluble. *Sodium monothioxyarsenate*,  $\text{Na}_3\text{AsO}_3\text{S} \cdot 12\text{H}_2\text{O}$ , has been obtained in the pure condition from arsenic acid by passing hydrogen sulphide through a solution of it, filtering, and then leaving the filtrate for 24 hours in contact with excess of magnesium oxide; to the filtrate from the magnesium precipitate, alkali is added in quantity sufficient to precipitate all the magnesium; on adding barium hydroxide to the filtered solution, a precipitate of sodium barium monothioxyarsenate is formed, which is exactly decomposed with sodium carbonate or sulphate and the sodium monothioxyarsenate thrown down in crystals by the addition of alcohol.

*Sodium dithioxyarsenate*,  $\text{Na}_3\text{AsO}_2\text{S}_2 \cdot 11\text{H}_2\text{O}$ , is prepared by allowing an excess of hydrogen sulphide to act on a solution of arsenic acid for some time, then expelling the excess of gas, and treating the solution with strontium hydroxide; the arsenic and monothioxyarsenic acids are then removed and barium hydroxide added to the filtrate to precipitate barium dithioxyarsenate, which is converted into the sodium salt by treatment with sodium sulphate.

J. McC.

**Condition of Silicon in Cast Iron and Ferrosilicon.** By PAUL LEBEAU (*Compt. rend.*, 1901, 133, 1008—1010).—Nitric acid and cupric potassium chloride have no action on very finely divided amorphous silicon, and hence the fact that these reagents dissolve or oxidise the silicon in cast iron and ferrosilicons containing a low proportion of silicon shows that in these substances the silicon must be in the form of iron silicides. The author has obtained only three definite compounds of iron and silicon,  $\text{Si}_2\text{Fe}$ ,  $\text{SiFe}$ , and  $\text{SiFe}_2$ . The first is found only in presence of excess of silicon and therefore cannot exist in cast iron and similar products. The monosilicide is readily dissociated and cannot exist in a matrix poor in silicon; it is decom-

posed into silicon and the compound  $\text{SiFe}_2$  when fused with silver. The silicide,  $\text{SiFe}_2$ , which contains the lowest proportion of silicon of any compound of the two elements which the author was able to obtain, is stable even at  $1000^\circ$ ; it dissolves in melted silver but is not decomposed. This is the form in which silicon exists in siliceous cast iron and its uniform distribution is due to the ease with which it dissolves in iron, whilst the consequent fine state of division in which it exists in the solidified metal is the reason why it is gradually attacked by nitric acid, which is almost without action on this silicide if it has been produced in the electric furnace.

C. H. B.

**Radium.** By MARCELLIN BERTHELOT (*Compt. rend.*, 1901, 133, 973—975).—The decomposition of iodic acid by radium (this vol., ii, 18) is due to the phosphorescent rays and does not take place either at  $10^\circ$  or  $100^\circ$  if a screen of black paper is placed between the radium and the iodic acid. The action of radium on glass is more rapid at  $100^\circ$  than at the ordinary temperature.

C. H. B.

**Preparation and Properties of Potassium Hydride.** By HENRI MOISSAN (*Compt. rend.*, 1902, 134, 18—21).—The action of hydrogen on potassium at  $360^\circ$  yields the hydride,  $\text{KH}$ , in slender, white, acicular crystals, very readily decomposed by atmospheric moisture and by water. It takes fire at the ordinary temperature in fluorine, chlorine, or oxygen, and when gently heated decomposes carbon dioxide, hydrogen sulphide, and lead and copper oxides. It does not react with liquid ammonia under the ordinary pressure, but in sealed tubes a compound is formed which dissolves in excess of the liquid; when heated in ammonia gas at about  $400^\circ$ , potassamide is formed. Potassium hydride is insoluble in terebenthene, benzene, ether, or carbon disulphide.

C. H. B.

**Melting Points of Alloys of Sodium with Potassium.** By NICOLAI S. KUENAKOFF and N. A. PUSHIN (*J. Russ. Phys. Chem. Soc.*, 1901, 33, 588—592).—The relations between melting point and composition are given, in the form of curves and tables, for mixtures of sodium and potassium. The melting point curve shows a transition point ( $6.88^\circ$ ) for the alloy of the composition  $\text{Na}_{1.497}\text{K}$  and a eutectic point,  $-12.5^\circ$ , corresponding with the compound  $\text{NaK}_2$ .

T. H. P.

**Rubidium and Cæsium Phosphates.** By EDUARD VON BERG (*Ber.*, 1901, 34, 4181—4185).—*Rubidium dihydrogen phosphate*,  $\text{RbH}_2\text{PO}_4$ , obtained by evaporating an aqueous solution containing mol. proportions of rubidium hydroxide and phosphoric acid, crystallises in large, colourless, anhydrous prisms and is acid to litmus. *Dirubidium hydrogen phosphate*,  $\text{Rb}_2\text{HPO}_4 \cdot \text{H}_2\text{O}$ , is obtained by concentrating an aqueous solution of the proper quantities of phosphoric acid and rubidium carbonate, adding ammonia to precipitate a crystalline *rubidium ammonium phosphate*, and drying the latter in a vacuum over sulphuric acid until all the ammonia is removed; if the treatment with ammonia is not adopted, the salt cannot be obtained

crystalline; its solution is alkaline to litmus. *Trirubidium phosphate*,  $\text{Rb}_3\text{PO}_4 \cdot 4\text{H}_2\text{O}$ , obtained by concentrating an aqueous solution of phosphoric acid (2 mols.) and rubidium carbonate (3 mols.), crystallises in short, thick, colourless, hygroscopic prisms. *Rubidium metaphosphate*,  $\text{RbPO}_3$ , obtained by heating the monorubidium phosphate, is a white powder, which, unlike the analogous sodium and potassium salts, is soluble in water. *Rubidium pyrophosphate*,  $\text{Rb}_4\text{P}_2\text{O}_7$ , is a white, hygroscopic mass.

*Cæsium dihydrogen phosphate*,  $\text{CsH}_2\text{PO}_4$ , forms beautiful, colourless, lustrous, anhydrous plates; *dicæsium hydrogen phosphate*,  $\text{Cs}_2\text{HPO}_4 \cdot \text{H}_2\text{O}$ , which is very soluble in water, is a white, microcrystalline solid, whilst *tricæsium phosphate*,  $\text{Cs}_3\text{PO}_4 \cdot 5\text{H}_2\text{O}$ , forms small, white, deliquescent crystals with an alkaline reaction. *Cæsium metaphosphate* and *pyrophosphate* are similar to the analogous rubidium compounds.

W. A. D.

**Combining Weight of Calcium.** By F. WILLY HINRICHSSEN (*Zeit. physikal. Chem.*, 1901, 39, 311—322).—The weight of calcium oxide left on ignition of about 30 grams of Iceland spar in an electric furnace of suitable form was determined. The Iceland spar gave 0.032 per cent. of ferric oxide and contained neither silicic acid nor magnesium, and only a trace of aluminium. During the ignition, the spar was heated in a platinum crucible furnished with a lid through which two tubes passed. A current of purified air was drawn through the apparatus during the experiment, and the tubes were carefully closed during weighing to prevent access of moisture and carbon dioxide. Four experiments gave a mean value of 40.142 for the atomic weight of calcium when  $\text{O} = 16$ .

J. McC.

**Formation of Oceanic Salt Deposits, particularly of the Stassfurt Beds. XXIV. Gypsum and Anhydrite. 3. Natural Anhydrite and its Formation at 25°.** By JACOBUS H. VAN'T HOFF and FRITZ WEIGERT (*Sitzungsber. K. Akad. Wiss. Berlin*, 1901, 48, 1140—1148. Compare Abstr., 1901, ii, 506, and this vol., ii, 74).—In presence of sodium chloride, the transition point of gypsum is lowered; by dilatometric experiments, it has been found that the transition in this case takes place near 30°. The tension of the gypsum-anhydrite mixture at this temperature is the same as that of the saturated sodium chloride solution and has been found to be 24 mm.

In presence of sodium bromate, the transition takes place near 50°, and the tension is then 83.3 mm. The tension at any other temperature can be found from the formula  $\log P_g = \log P_w - 341/T + 1.0072$ , where  $P_g$  is the tension of the gypsum and  $P_w$  that of water at the temperature  $T$ .

In concluding the work on the transition of gypsum, the authors sum up the results obtained as follows. Gypsum is transformed (1) into natural anhydrite:

A. At 66°. B. In presence of sodium chloride at 30°.

(2) Into soluble anhydrite:

C. At 89°. D. In presence of sodium chloride at 65°.

(3) Into semihydrate:

E. At 107°. F. At 101.5°, under atmospheric pressure (boiling

point) G. In presence of magnesium chloride at  $11^{\circ}$ . H. In presence of sodium chloride at  $76^{\circ}$ .

Solutions containing calcium sulphate which have a tension lower than 17.2 mm. at  $25^{\circ}$  deposit it as anhydrite. This is the case in the deposition from sea-water. J. McC.

**Metallic Strontium and its Hydride.** By ANTOINE GUNTZ (*Compt. rend.*, 1901, 133, 1209—1210. Compare Gautier, following abstract).—Strontium amalgam is very easily prepared when an aqueous solution of strontium chloride is electrolysed, using mercury as cathode. From the amalgam, metallic strontium is obtained by distilling off the mercury in a vacuum. *Strontium hydride*,  $\text{SrH}_2$ , is prepared by heating strontium or its amalgam in a current of hydrogen, and is a white solid which fuses only at a red heat. Strontium does not dissolve in liquid ammonia as does barium. K. J. P. O.

**Alloys of Strontium with Zinc and Cadmium.** By HENRI GAUTIER (*Compt. rend.*, 1901, 133, 1005—1008).—An alloy of zinc and strontium containing 12—14 per cent. of the latter can be obtained by the action of sodium on a mixture of strontium and zinc chlorides, the excess of sodium being removed by treatment with alcohol. A similar alloy containing 18 per cent. of strontium is obtained by the action of sodium on strontium iodide in presence of zinc. Attempts to obtain richer alloys by partially volatilising the zinc were unsuccessful, since both metals volatilised together. Cadmium strontium alloys containing 18 to 20 per cent. of strontium were obtained in a similar manner, and by heating these at  $250\text{--}300^{\circ}$  in a vacuum the strontium is concentrated up to as much as 45 per cent. The latter alloy can be polished with a file, but the surface rapidly tarnishes; it burns readily in oxygen, phosphorus vapour, and chlorine, and reacts with sulphur below its boiling point and with iodine at a dull red heat. When heated at dull redness in hydrogen, a white strontium hydride,  $\text{SrH}_2$ , is formed and can be isolated by volatilising the cadmium in a vacuum. C. H. B.

**Preparation of Barium.** By ANTOINE GUNTZ (*Compt. rend.*, 1901, 133, 872—874).—Barium amalgam, which is readily obtained by electrolysing a concentrated solution of barium chloride in contact with a mercury cathode, is heated in a porcelain tube by means of an electric current passed through a thin platinum wire until a temperature of  $1150^{\circ}$  is reached. All the mercury is driven off at lower temperatures, and the final distillate consists of barium containing 97.8 per cent. of the metal. This element, when freshly cut, has a silvery lustre, but it rapidly oxidises and often takes fire in the atmosphere. The metal melts below  $1000^{\circ}$ , and is readily volatilised at a bright red heat; it yields, with liquid ammonia, a compound which seems to be more stable than its lithium and calcium analogues.

Barium readily decomposes water, absolute alcohol, and even a solution of barium ethoxide. G. T. M.

**Preparation of Barium.** By EDGAR STANSFIELD (*Mem. Manchester, Phil. Soc.*, 1901, 46, No. 4, 1—6).—A solid, crystalline amal-



gam, containing nearly 5 per cent. of barium, can be easily obtained by the electrolysis of a saturated solution of barium chloride, using a mercury cathode. An alloy containing 12 per cent. of barium is obtained by heating a mixture of zinc, sodium, barium chloride, and sodium chloride. But in neither case can pure barium be obtained by distillation of the mercury or zinc. A hard, thick, metallic mass containing crystalline flakes and nodules of metal is obtained by heating barium peroxide with finely divided aluminium in a vacuum. It contains 63.3 to 66.6 per cent. of barium, and 19.3 to 29.3 per cent. of aluminium; the metallic nodules mentioned above contain 58 per cent. of barium and 42 per cent. of aluminium. The metallic flakes and nodules decompose water very rapidly but are stable when exposed to dry air. The results indicate that the reaction between barium peroxide and aluminium is a reversible one and that it cannot be used to obtain pure barium. With calcium oxide, the reaction did not take place, and on replacing the aluminium by magnesium, the reaction was too violent and shattered the apparatus. E. C. R.

**Action of Ammonia and Potassium Hydroxide on Solutions of Zinc Salts.** By BASIL B. KURILOFF (*Chem. Centr.*, 1901, ii, 1222; from *Bull. Acad. St. Petersb.*, 1901, No. 1, 95—103).—The excess of ammonia or potassium hydroxide which is necessary to dissolve the precipitate formed when the alkali is added to a solution of zinc chloride or sulphate has been determined, and the results show that in both cases the more dilute the solutions of ammonia or potassium hydroxide, the greater must be the actual proportion of alkali to zinc salt. Solutions weaker than decinormal do not appreciably affect the precipitate. The proportion of alkali required is also greater for solutions of the sulphate than for those of the chloride, but the data obtained for these two solutions are otherwise very similar. No quantitative determinations to show the influence of the chlorine or sulphate ions are given, but the solid phase which is formed when potassium hydroxide acts on zinc sulphate contains sulphate, and this group cannot be removed by washing with water. E. W. W.

**Alloys of Thallium.** By NICOLAI S. KURNAKOFF and N. A. PUSHIN (*J. Russ. Phys. Chem. Soc.*, 1901, 33, 565—588).—The authors have determined the relations between melting point and composition for mixtures of thallium with the following metals: sodium, potassium, tin, cadmium, and mercury, the results being expressed both in curves and in tables. It is found that in combination with potassium or sodium, and also with tin or cadmium, thallium behaves similarly to heavy metals having an acid character, such as mercury and lead, which it also resembles physically in the free state; in alloys with mercury, bismuth, or lead, however, thallium plays a part similar to that of the alkali metals. The melting point curves for sodium-thallium, and potassium-thallium show eutectic points corresponding with alloys of the composition NaTl and KTl; the first of these compounds melts at 305.8° and the latter at 335.0°. The authors' results serve to complete the following series of sodium alloys: NaHg<sub>2</sub>, NaTl, Na<sub>2</sub>Pb, Na<sub>3</sub>Bi, in which it will be seen that corresponding with the

increase of the atomic weight and acid properties of the heavy metal, an increase occurs in the relative number of sodium atoms in a molecule of the alloy.  
T. H. P.

**Action of Cupric Hydroxide on Aqueous Solutions of Metallic Salts.** By AMABLE MAILHE (*Compt. rend.*, 1902, 134, 42—45).—The action of the black hydrate of cupric oxide on aqueous solutions of various metallic sulphates yields the following results: with cadmium, at the ordinary temperature, bluish-green, rhombic plates of the compound  $2\text{CdSO}_4 \cdot 3\text{CuO} \cdot 12\text{H}_2\text{O}$ , and at  $100^\circ$ , green, hexagonal crystals of the compound  $2\text{CdSO}_4 \cdot 3\text{CuO} \cdot 10\text{H}_2\text{O}$ ; with nickel, strictly analogous compounds, in green crystals; with cobalt, at the ordinary temperature, maroon coloured crystals of the compound  $3\text{CoSO}_4 \cdot 5\text{CuO} \cdot 16\text{H}_2\text{O}$ , and at  $100^\circ$ , maroon coloured, hexagonal plates of the compound  $2\text{CoSO}_4 \cdot 3\text{CuO} \cdot 10\text{H}_2\text{O}$ . With zinc at the ordinary temperature, the composition of the product varies with the concentration of the solution from  $\text{ZnSO}_4 \cdot 3\text{CuO} \cdot 5\text{H}_2\text{O}$  to  $2\text{ZnSO}_4 \cdot 3\text{CuO} \cdot 12\text{H}_2\text{O}$ , the latter being the sole product at  $100^\circ$ . Manganese is not displaced from manganous sulphate by cupric oxide, but mercury, aluminium, and iron (ferric) are completely displaced (compare *Abstr.*, 1901, ii, 601).  
C. H. B.

**The Oxidising Action of Copper Salts.** By EDUARD SCHAEER (*Arch. Pharm.*, 1901, 239, 610—626. Compare *Abstr.*, 1900, i, 512; ii, 583).—An account of the way in which different substances accelerate the oxidising action of cupric salts, especially its salts with the organic acids, on iodide of starch, guaiacum, indigo, cyanine, pyrogallol, brazilin, aniline, *p*-phenylenediamine, guaiacol, or aloin. Hydrocyanic acid, soluble ferrocyanides, ferricyanides, thiocyanates, and nitroprussides, cyanogen iodide, organic cyanides and thiocarbimides, iodine, bromides and chlorides, ammonia and alkaloids, hydrogen peroxide, sulphurous acid and sulphites, and colloidal platinum and gold are all found to produce a greater or less acceleration.  
C. F. B.

**Praseodymium Peroxide and Dioxide.** By PETR. G. MELIKOFF and B. E. KLIMENKO (*J. Russ. Phys. Chem. Soc.*, 1901, 33, 663—666).—The basic character of the two oxides of praseodymium, observed by former investigators, indicates that this element cannot be placed in the periodic system between niobium and tantalum.

On cautiously adding dilute potassium hydroxide solution to a hydrogen peroxide solution of the sulphate or nitrate of the metal, a pale green, gelatinous precipitate is formed, having in the first instance the probable formula  $\text{Pr}(\text{O}_2\text{H})_3$ ; this compound, however, quickly decomposes, yielding free oxygen and the hydrate of praseodymium monoperoxide,  $\text{Pr}(\text{OH})_2 \cdot \text{O}_2\text{H}$ , which loses water when kept. Under the action of dilute sulphuric acid, this hydrated peroxide yields hydrogen peroxide, whilst with the concentrated acid ozone is formed; aqueous potassium hydroxide is oxidised by the hydrate to potassium peroxide, but no conversion of manganese salts into permanganic acid takes place in presence of nitric acid.

Praseodymium dioxide,  $\text{PrO}_2$ , yields, with dilute sulphuric acid, no

hydrogen peroxide but ozone ; in presence of nitric acid, however, it oxidises manganese sulphate to permanganic acid.

The author concludes that the peroxide  $\text{Pr}_2\text{O}_5$  is a compound of the type  $\text{H}_2\text{O}_2$ , but that the dioxide cannot be regarded as such.

T. H. P.

**Alloys of Aluminium and Magnesium.** By OCTAVE BOUDOUARD (*Compt. rend.*, 1901, 133, 1003—1005).—By treating fused mixtures of aluminium and magnesium in various proportions with ammonium chloride solution or dilute hydrochloric acid, the author has isolated three definite crystalline compounds of the two metals:  $\text{AlMg}_{22}$ , sp. gr. 2.03, from a mixture of 30 parts of aluminium and 70 parts of magnesium;  $\text{AlMg}$ , sp. gr. 2.15, from mixtures of 40 to 50 parts of aluminium with 60 to 50 parts of magnesium, and  $\text{Al}_4\text{Mg}$ , sp. gr. 2.58, from mixtures of 70 parts of aluminium and 30 parts of magnesium. All the fused mixtures of the two metals, except that containing equal parts of each, show dendritic crystals in considerable quantity. The existence of the compounds  $\text{AlMg}_2$  and  $\text{AlMg}$  was predicted from determinations of the melting points of the two metals (*Abstr.*, 1901, ii, 512).

C. H. B.

**Action of Aluminium on Salt Solutions and on Molten Salts.** By CARLO FORMENTI and MARIO LEVI (*Chem. Centr.*, 1901, ii, 1298; from *Boll. Chim. Farm.*, 1901, 40, 689—696).—From experiments on the reduction of salts of gold, platinum, palladium, cadmium, lead, tin, beryllium, cerium, niobium, thorium, zirconium, chromium, uranium, thallium, ammonium, zinc, iron, manganese, mercury, antimony, arsenic, bismuth, silver, copper, cobalt, nickel, silicon, and boron by aluminium, this metal is found to be a more powerful reducing agent than the metals commonly used for this purpose. In many cases, the aluminium does not completely replace the metal which is contained in the salt, and the reduced metal is often mixed with more or less aluminium, forming an alloy. In other cases, the metal which first separates subsequently forms a basic salt or is oxidised. By the action of aluminium on some sulphates, alums are formed, and the metal even attacks aqueous solutions of aluminium chloride, forming a hydrate of a subchloride and liberating hydrogen. The reduction of metallic chlorides takes place the more readily the greater the difference between the heat of formation of aluminium chloride and that of the metallic chloride, and this is also the case with other salts.

E. W. W.

**Preparation of Crystallised Alumina in the Electric Furnace and some Bye-products of this Process.** By WILHELM H. GINTL (*Zeit. angew. Chem.*, 1901, 14, 1173—1179).—Different specimens of bauxite, with a small amount of powdered coal and a quantity of sodium chloride, were fused in an electric furnace. A 100 volt current was used. After the whole mass had become fused, it was allowed to run out; at first, a limpid metal flowed out, and was followed by a more viscid slag. The metal is brittle, and its density (at  $15^\circ$ ) varies between 6.75 and 6.78. It consists chiefly of iron (83

per cent.) and silicon (14 per cent.), and small amounts of manganese, aluminium, carbon, phosphorus and titanium. The slag, on cooling, assumes a microcrystalline structure and is of a grey or brownish-grey colour. On breaking up the slag, small quantities of another metal and large blue and brown crystals were obtained; the metal consists mainly of aluminium (61 per cent.), iron (13 per cent.), and silicon (19 per cent.), along with smaller quantities of carbon, titanium, sodium, calcium, copper, and sulphur.

The blue and brown crystals were examined crystallographically; they have the same form, and belong to the hexagonal-rhombohedral system ( $0001 : 10\bar{1}1 = 57^{\circ}33'$ , which is nearly identical with the corresponding angle on natural corundum), and are uniaxial. The brown crystals (sp. gr. 3.55) contain about 82 per cent. of alumina, about 12.25 per cent. of silica, and small quantities of iron, manganese, sodium, and titanium. The blue crystals (sp. gr. 3.81) contain from 66 to 70 per cent. of alumina, about 16 per cent. of silica, considerable quantities of the oxides of iron and sodium, and smaller amounts of manganese, calcium, magnesium, and titanium oxides.

The author believes that the blue colour is due to the presence of a low oxide of titanium, and not to cobalt, because the presence of the former element has been established, but no cobalt could be detected, even when large quantities of the crystals were used. The titanium oxide is reduced by the carbon electrode at the high temperature. It was found that when pure alumina was fused with alkali and a little titanous acid, a blue mass was produced at the place where the carbon electrode was in immediate contact with the fused mass.

On treating splinters of the crystals with moderately dilute sulphuric acid, they are partially dissolved, and the undissolved portion consists entirely of alumina. In all probability, the crystals are not homogeneous, but consist of a framework of pure alumina permeated by thin layers of a sodium aluminosilicate and varying quantities of calcium, magnesium, manganese, and ferrous oxides.

The blue colour of the sapphire is also attributed to the presence of a low oxide of titanium, and this is supported by the fact that when the sapphire is heated in air it loses its blue colour and becomes brown.

The presence of ruby-red crystals in the bauxite slag has also been observed.

J. McC.

**Compounds of Aluminium Chloride with the Alkali Chlorides.** By E. BAUD (*Compt. rend.*, 1901, 133, 869—871).—The double chlorides,  $\text{Al}_2\text{Cl}_6 \cdot 2\text{NaCl}$  and  $\text{Al}_2\text{Cl}_6 \cdot 2\text{KCl}$ , have the heats of dissolution, 141.42 Cal. and 120.44 Cal. respectively, their calculated heats of formation being 11.84 Cal. and 26.38 Cal.

The compound  $\text{Al}_2\text{Cl}_6 \cdot 2\text{NH}_4\text{Cl}$ , made by fusing together its generators in the theoretical proportions, may be distilled without decomposition; its heats of dissolution and formation are 120.943 Cal. and 26.53 Cal. respectively.

*Compounds* of the type  $\text{Al}_2\text{Cl}_6 \cdot 3\text{MCl}$  are produced by employing 3 mols. of sodium or potassium chloride at  $500^{\circ}$ ; the heats of formation of the sodium and potassium salts are 15.29 and 30.53 Cal. respectively, these values being calculated from the corresponding heats of

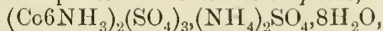


formation, 136.97 and 112.07 Cal. The addition of the third molecule of alkali chloride to the double salt,  $\text{Al}_2\text{Cl}_6 \cdot 2\text{MCl}$ , is accompanied by a development of heat.

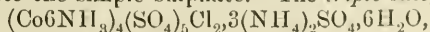
*Double salts* of the type  $\text{Al}_2\text{Cl}_6 \cdot 6\text{MCl}$  are obtained by adding the compounds  $\text{Al}_2\text{Cl}_6 \cdot 2\text{MCl}$  to the calculated quantity of fused alkali chloride. The heats of dissolution of the sodium and potassium compounds are 129.73 and 93.304 Cal. respectively, and from these values the corresponding heats of formation are calculated, namely, 19.45 and 36.636 Cal. It follows therefore that the addition of the last three mols. of alkali chloride is also accompanied by a development of heat. Thermochemical measurements indicate the existence of double salts containing even a larger proportion of alkali chloride, but the heat change is so small that it becomes impossible to determine the exact composition of these compounds. G. T. M.

**Acid Ferric Sulphate.** By RUDOLF SCHARIZER (*Zeit. Kryst. Min.*, 1901, 35, 345—356. Compare Abstr., 1899, ii, 30; 1900, ii, 349).—The white powder obtained when a solution of ferrous sulphate is allowed to oxidise and evaporate in the air, as well as many commercial samples of ferric sulphate, contain  $\text{Fe}_2\text{O}_3 : \text{SO}_3$  in the ratio 1 : 4. This excess of sulphuric anhydride over that required for normal ferric sulphate is not due, as often supposed, to the presence of free sulphuric acid, but the substance is a definite acid salt with the composition  $\text{Fe}_2\text{S}_4\text{O}_{18}\text{H}_6 \cdot 6\text{H}_2\text{O}$ . It is prepared by adding as much ferric hydroxide as will dissolve to boiling dilute sulphuric acid, diluting, and adding sulphuric acid until the solution contains  $\text{Fe}_2\text{O}_3 : \text{SO}_3 = 1 : 4$ ; as the solution evaporates, small rhombic crystals of the salt are deposited. Part of the water is given off below  $100^\circ$ , and the remainder with some sulphuric anhydride at  $140^\circ$ . A structural formula represents the substance as a basic, acid salt,  $\text{Fe}_2(\text{OH})_2(\text{SO}_4\text{H})_4 \cdot 6\text{H}_2\text{O}$ . L. J. S.

**Luteocobaltic Salts.** By TIMOTHÉE KLOBB (*Bull. Soc. Chim.*, 1901, [iii], 25, 1022—1031).—Luteocobaltic chloride is best prepared by dissolving cobaltous chloride and ammonium chloride in water, pouring into cold concentrated ammonia, oxidising first in the cold by means of a current of air, and then by means of lead peroxide on a water-bath. The nitrate and sulphate can be prepared by similar methods. The *acid sulphate*,  $4(\text{Co}6\text{NH}_3)_2(\text{SO}_4)_3 \cdot 5\text{H}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ , prepared by the action of an excess of sulphuric acid on the normal sulphate, forms birefringent, orthorhombic, octahedral crystals, does not lose in weight when heated at  $100^\circ$ , but loses  $9\text{H}_2\text{O}$  at  $120$ — $130^\circ$ ; by crystallising from water, it is reconverted into the normal sulphate. The *chloro-sulphate*,  $(\text{Co}6\text{NH}_3)\text{ClSO}_4 \cdot 3\text{H}_2\text{O}$ , forms orthorhombic prisms and is only very slightly soluble in cold water; the roseocobaltic salts do not give a chlorosulphate. The *double sulphate*,

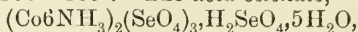


forms large, orthorhombic prisms, often several grams in weight, and loses  $6\text{H}_2\text{O}$  when left over sulphuric acid; crystallisation from water reconverts it into the simple sulphate. The *triple salt*,



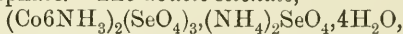
forms brilliant octahedra belonging to the cubic system, which do not lose weight at  $100^{\circ}$  but become opaque at  $120^{\circ}$ .

The *chlorochromate*,  $(\text{Co}_6\text{NH}_3)\text{CrO}_4\text{Cl}, 3\text{H}_2\text{O}$ , forms brilliant needles isomorphous with the crystals of the chlorosulphate. The *selenate*,  $(\text{Co}_6\text{NH}_3)_2(\text{SeO}_4)_3, 5\text{H}_2\text{O}$ , forms large crystals, is very soluble in water, and loses  $4\text{H}_2\text{O}$  at  $100-105^{\circ}$ . The *acid selenate*,



forms large, glistening, triclinic crystals, rapidly effloresces, loses all its water at  $100-105^{\circ}$ , and, unlike the acid sulphate, can be crystallised from water.

The *chloro-selenate*,  $(\text{Co}_6\text{NH}_3)\text{SeO}_4\text{Cl}, 3\text{H}_2\text{O}$ , forms small, glistening, striated, orthorhombic crystals isomorphous with those of the chlorosulphate. The *double selenate*,  $(\text{Co}_6\text{NH}_3)_2(\text{SeO}_4)_3, (\text{NH}_4)_2\text{SO}_4, 8\text{H}_2\text{O}$ , forms soluble, orthorhombic crystals isomorphous with those of the corresponding sulphate. The *double selenate*,



forms large, monoclinic prisms.

The *acetate*,  $(\text{Co}_6\text{NH}_3)(\text{C}_2\text{H}_3\text{O}_2)_3, 3\text{H}_2\text{O}$ , forms long prisms or hexagonal plates, which do not lose weight at  $100^{\circ}$ , but are completely dehydrated at  $125^{\circ}$ ; it dissolves in less than its own weight of water at  $15^{\circ}$ , and is hygroscopic. The succinate was not obtained in a crystalline form; a *benzoate* was obtained in brilliant plates, but was not analysed.

T. M. L.

**Chromic Chloride.** By PAUL ROHLAND (*Zeit. anorg. Chem.*, 1901, 29, 159—162).—Violet chromic chloride, which is insoluble in water, remains unchanged when hydrogen is passed through the solution below  $90^{\circ}$ , but at and above this temperature transformation to the green modification and consequent solution takes place.

All the metals, except gold and platinum, effect the solution of the violet chromic chloride, and the order of the degree of influence is the same as the electromotive series of the metals.

Violet chromic chloride, when shaken with precipitated tin, passes quickly into solution. In the solution, tin ions are also to be found, because stannous chloride and chromous chloride are formed. It is doubtful whether the catalysis is to be attributed to the metal or to the chromous chloride formed.

J. McC.

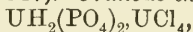
**The Number of the Blue Oxides of Molybdenum.** By G. BAILHACHE (*Compt. rend.*, 1901, 133, 1210—1213. Compare Abstr., 1901, ii, 243).—A blue substance of indefinite composition is formed when a concentrated solution of the sulphate,  $\text{Mo}_2\text{O}_5, 2\text{SO}_3$  (*loc. cit.*), is exposed to the air; an *oxide*,  $\text{Mo}_2\text{O}_3, 2\text{MoO}_4, 6\text{H}_2\text{O}$ , is obtained when the sulphate is heated with barium molybdate,  $\text{BaMoO}_4$ , and water at  $100^{\circ}$ , in a current of carbon dioxide; on evaporating the blue liquid under reduced pressure, the oxide is left as a bluish-black solid. When ordinary barium molybdate,  $\text{Ba}_3\text{Mo}_7\text{O}_{24}$ , is used, another blue *oxide*,  $3\text{Mo}_2\text{O}_3, 2\text{Mo}_7\text{O}_{24}, 18\text{H}_2\text{O}$ , is formed. With alkalis, both oxides are converted into a pale buff-coloured powder.

K. J. P. O.

**Phosphorus Molybdenum Compounds. II.** By F. MAWROW (*Zeit. anorg. Chem.*, 1901, 29, 156—158. Compare this vol., ii, 25).—The compound  $\text{Mo}_5\text{O}_{13}(\text{H}_3\text{PO}_2)_8, \text{H}_2\text{O}$ , previously described, is soluble

in water to a blue solution and gives precipitates with solutions of salts of ammonium, barium, lead, and bismuth. The barium salt has the formula  $\text{BaO}, \text{Mo}_7\text{O}_{20}, (\text{H}_3\text{PO}_2)_3, 12\text{H}_2\text{O}$ . J. McC.

**Uranium and its Compounds.** By JULES ALOY (*Ann. Chim. Phys.*, 1901, 24, [vii], 412—432).—The greater portion of this work has been already published (compare Abstr., 1899, ii, 555, 599; 1900, ii, 484; 1901, ii, 164, 244, 317). *Uranous chlorophosphate*,



separates in green crystals from a solution of uranous phosphate,  $\text{UH}_2(\text{PO}_4)_2, 5\text{H}_2\text{O}$ , in concentrated hydrochloric acid. *Uranyl iodide*,  $\text{UO}_2\text{I}_2$ , prepared by adding a slight excess of barium iodide to an ethereal solution of the nitrate,  $\text{UO}_2(\text{NO}_3)_2, 3\text{H}_2\text{O}$ , separates in red, deliquescent crystals which are very readily decomposed. *Potassium uranyl cyanide*,  $\text{UO}_2(\text{CN})_2, 2\text{KCN}$ , obtained by treating a dilute solution of uranyl acetate with a large excess of solid potassium cyanide, forms a voluminous, bulky precipitate, which subsequently changes into a mass of pale yellow prisms. G. T. M.

**Complete Freezing Point Curves of Binary Alloys.** By A. W. KAPP (*Ann. Phys.*, 1901, [iv], 6, 754—773).—Freezing point determinations have been made at intervals of 10 per cent. for each binary combination of the metals bismuth, tin, lead, and cadmium. The temperatures at which a solid separated out from the liquid alloy were determined from the halts in the cooling curve. The author finds that in no case does the eutectic alloy correspond with simple atomic proportions of the components (compare Guthrie, Abstr., 1885, 329; Miolati, Abstr., 1892, 1139; Dams, *Ann. Phys. Chem.*, 1895, 54, 486). The eutectic alloys are found to have the following composition:

Tin-bismuth	.....	56 per cent.	Bi	Cadmium-tin	70 per cent.	Sn
Lead-bismuth	.....	57	„ Bi	Lead-tin	.....	66 „ Sn
Cadmium-bismuth	60	„ Bi		Lead-cadmium	16	„ Cd.

The values given for the composition of the three eutectic bismuth alloys differ somewhat from those given by Guthrie, especially in the case of tin-bismuth. J. C. P.

## Mineralogical Chemistry.

**Graphite Deposits of Battugol.** By L. JACZEWSKI (*Jahrb. Min.*, 1901, ii, Ref. 74—77; from *Explorations géol. et minières le long du chemin de fer de Sibérie*, Livre XI, 1899, 19—56).—The graphite of the Alibert mines at Battugol (Botogolskij-Golez) occurs in limestone and in nepheline-augite-syenite. Under I are the results of an analysis of the latter rock; II of the augite from the same rock (also loss on ignition, probably representing graphite, 1.63

per cent.); III of augite free from alkalis from a similar rock. Determinations of the sp. gr. and rate of combustion point to the material being mainly the graphite of Luzi rather than graphite.

	SiO <sub>2</sub> .	TiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	Total.
I.	55·41	—	19·84	9·50	—	3·86	—	5·29	5·97	99·87.
II.	38·00	—	8·57	39·54	—	11·50	—	0·27	2·80	102·31.
III.	44·15	1·85	—	—	34·13	20·17	0·40	—	—	100·70.

L. J. S.

**Inflammable Gas in the Netherlands.** By J. LORIE (*Jahrb. Min.*, 1901, ii, Ref. 84; from *Tijdschr. k. Nederl. aardrijkskundig Genotsch. Leiden.*, 1899, 35 pp.).—It has long been known that inflammable, sometimes self-igniting, gas, is exuded from the ground at many places in North and South Holland and Friesland. The sandy alluvial ground contains remains of plants and shells and there is no doubt that to these substances the gas owes its origin. Bore holes are put down to a depth of 12 to 80 metres to collect the gas, the results of two analyses of which are :

CH <sub>4</sub> .	CO <sub>2</sub> .	N.	O.	H.	CO.
97·7	10·4	9·0	0·5	0·4	—
74·8	3·4	16·2	0·4	4·6	0·6

L. J. S.

**Analysis of Manganese [Minerals] from Sardinia.** By C. RIMATORI (*Atti Real. Accad. Lincei*, 1901, [v], 10, ii, 226—232).—Analyses and physical properties of manganese minerals found in Sardinia. They are mostly varieties of pyrolusite. Two of the samples must, however, be regarded as psilomelane and one, containing 20·68 per cent. PbO, resembles a specimen of wad (Wackenrodite) from Baden. In all the specimens examined, the manganese was only present in the form of nodules or small fragments.

T. H. P.

**[Chalcopyrite and Bornite as Furnace Products.]** By ALEXANDER N. WINCHELL (*Amer. Geologist*, 1901, 28, 244—246).—The iron rails in the bed of a calciner for copper ores at Butte, Montana, become in a few months converted into chalcopyrite with which is a little bornite. Analyses are given of the chalcopyrite.

L. J. S.

**Manganosphærite, a new variety of Oligonite.** By KARL BUSZ (*Jahrb. Min.*, 1901, ii, 129—132).—The chalybite vein of the Louise mine at Horhausen, Westerwald, is intersected by a dyke of basalt, the cavities in which are partly or wholly filled with botryoidal aggregates of a fawn-brown mineral resembling sphærosiderite in appearance. The following analysis shows, however, that the mineral differs from sphærosiderite (FeCO<sub>3</sub>) in containing much manganese, and that in composition (3FeCO<sub>3</sub>, 2MnCO<sub>3</sub>) it agrees with Breithaupt's oligon-spar, of which crystals only have been previously described.



FeO.	MnO.	CO <sub>2</sub> .	Total.	FeCO <sub>3</sub> .	MnCO <sub>3</sub> .	Sp. gr.
36·72	24·76	38·34	99·82	59·71	40·11	3·630

Microscopical examination shows that the mineral is homogeneous, and not a mixture of rhodochrosite (MnCO<sub>3</sub>) and chalybite (FeCO<sub>3</sub>).

L. J. S.

**Altered Peridotite in Mysore.** By THOMAS H. HOLLAND (*Mem. Geol. Survey India*, 1901, 34, 1—9).—Altered peridotites in Southern India are usually penetrated by veins of white magnesite, but in the rock from Huliya now described this is not the case. Here dark gray crystals of breunnerite from half an inch to an inch across are scattered through a matrix of talc and serpentine. The breunnerite, which encloses talc, serpentine and magnetite, gave on analysis the results under I corresponding with MgCO<sub>3</sub> : FeCO<sub>3</sub> = 10 : 1. The matrix of talc, serpentine, magnetite and a little pyrites gave II :

	SiO <sub>2</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	CO <sub>2</sub> .	H <sub>2</sub> O.	S.	Insol.	Total.	Sp.gr.
I.	—	2·93	8·27	trace	39·20	47·01	—	—	1·57	98·98	3·168
II.	42·20	13·59		—	30·41	5·30	7·73	0·11	—	99·34	2·853

L. J. S.

**[Datolite from] Canada.** By G. CHRISTIAN HOFFMANN (*Amer. J. Sci.*, 1901, [iv], 12, 447—448).—A compact white mineral from the Daisy mica mine, Derry, Ottawa, Co. Quebec, is proved by the following analysis, by R. A. A. Johnston, to be datolite :

SiO <sub>2</sub> .	B <sub>2</sub> O <sub>3</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	CaO.	MgO.	H <sub>2</sub> O.	Total.	Sp.gr.
36·94	22·37	0·12	0·02	34·90	0·05	5·68	100·08	2·985

Associated with it is the rare mineral faujasite.

L. J. S.

**Isomorphism of Plagioclase Felspars.** By FRANZ LOEWINSON-LESSING (*Centr. Min.*, 1901, 708—709. Compare Abstr., 1900, ii, 354 ; this vol., ii, 30).—The suggestion is put forward that albite and anorthite are not isomorphous, but form a series of double salts, and that these double salts enter into isomorphous mixture with each other, and perhaps also with the end members of the series.

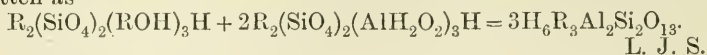
L. J. S.

**Colourless Chlorite from Aj River, Zlatoust.** By PETR A. ZEMJATSCHENSKY (*Zeit. Kryst. Min.*, 1901, 35, 357—360).—This occurs as colourless scales with hornblende and rutile in a white, crystalline, dolomitic limestone. It is optically positive, and the axial angle 2E varies from 0° to 50°. Sp. gr. 2·675—2·744 (mean 2·704). Analysis gave :

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	H <sub>2</sub> O.
31·053	24·301	0·454	1·776	2·090	24·493	12·391

This chlorite is remarkable in containing very little iron, and, except in the relative amounts of alumina and magnesia, it resembles leuchtenbergite in composition. Formula, 3RO, Al<sub>2</sub>O<sub>3</sub>, 2SiO<sub>2</sub>, 3H<sub>2</sub>O, or 2CaO, 38(Mg, Fe)O, 13Al<sub>2</sub>O<sub>3</sub>, 28SiO<sub>2</sub>, 37H<sub>2</sub>O. According to Tschermak's theory of the chlorite group, the composition may be expressed

by  $\text{Sp}_4\text{At}_{13}$ , but there is a remainder of  $\text{H}_6\text{Ca}_2\text{Si}_7\text{O}_{19}$  amounting to one-tenth of the whole. According to Clarke's theory, the formula is written as



**Elæolite-syenites and Corundum-syenites in Madras.** By THOMAS H. HOLLAND (*Mem. Geol. Survey India*, 1901, 30, 169—224).—A petrographical description is given of elæolite-syenites, augite-syenites and corundum-syenites from Sivamalai in the Coimbatore district. Analysis I is of the ordinary type of elæolite-syenite. II, of large crystals, sometimes five inches across, of yellow elæolite from the coarse-grained "contemporaneous veins" of elæolite-syenite which penetrate the rock of the ordinary type. III is of large crystals of grayish felspar from these veins:

	$\text{SiO}_2$ .	$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	$\text{CaO}$ .	$\text{MgO}$ .	$\text{K}_2\text{O}$ .	$\text{Na}_2\text{O}$ .	Loss on ignition.	Total.	Sp. gr.
I.	55.68	23.81	4.84	1.69	0.65	5.16	9.23	0.34	101.98	2.593
II.	43.35	34.32	1.02	0.82	—	5.52	14.62	0.75	100.40	2.62
III.	64.70	22.63	0.43	1.34	0.49	5.86	6.02	0.09	101.56	2.594

Corundum occurs as tabular, well-developed crystals in a rock consisting principally of felspar (albite and orthoclase), as in the Urals (*Abstr.*, 1899, ii, 763) and in Eastern Ontario (*Abstr.*, 1900, ii, 552).

L. J. S.

**The Veramin Meteorite.** By HENRY A. WARD (*Amer. J. Sci.*, 1901, [iv], 12, 453—459).—This Persian meteorite is one of the four siderolites which have been seen to fall; it fell in May, 1880, and weighs  $51\frac{2}{5}$  kilograms. It consists of 42.3 per cent. of silicates, and 57.7 per cent. of metal. Sp. gr. 4.57. The silicates present are, enstatite, olivine, possibly peckhamite, and a basic felspar. The metal has the following composition (analysis by J. E. Whitfield):

Fe.	Ni.	Co.	P.	S.	Sp. gr.
92.06	6.96	0.73	0.10	0.15	5.56

L. J. S.

**Red Rain or Blood Rain.** By NAPOLEONE PASSERINI (*L'Orosi*, 1901, 24, 325—332. Compare *Abstr.*, 1901, ii, 322, 456).—Analysis of the red matter falling with rain on March 10th, 1901, in various parts of Italy and Central Europe shows that it consists mainly of silica, aluminium and calcium silicates, ferric oxide and organic matter ( $\text{SiO}_2$  44.3709,  $\text{CaO}$  12.3964,  $\text{Al}_2\text{O}_3$  23.6159,  $\text{Fe}_2\text{O}_3$  6.9764; organic and volatile matter 10.4677 per cent.) with small quantities of other silicates, and of carbonates, sulphates, chlorides, nitrates, &c. The red colour is due especially to the ferric oxide and organic matter.

Mineralogical examination of the matter by Giovanni D'Achiardi shows it to consist of grains, varying in size but always small; the grains are mostly of quartz, but many other minerals are also present, including felspar, pyroxene, mica, chlorite, hæmatite, calcite, or dolomite, &c. Traces of *Diatomaceæ* may also be detected. The matter is probably of cyclonic origin.

T. H. P.

## Physiological Chemistry.

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**Influence of External Temperature on Warm-blooded Animals.** By ARTHUR FALLOISE (*Trav. du lab. de L. Fredericq, Liège*, 1901, 6, 183—208; from *Arch. de Biol.*, 17, 761).—In guinea pigs, rats, and pigeons, as the temperature of the air falls from 21° to 0°, the production of carbon dioxide increases, so that it may be doubled or even tripled. Above 21°, there is also an increase, but it is not so marked. In man, the same change occurs, but in a less regular manner. W. D. H.

**Influence of Breathing an Atmosphere rich in Oxygen.** By ARTHUR FALLOISE (*Trav. du lab. de L. Fredericq, Liège*, 1901, 6, 135—182; from *Arch. de Biol.*, 17, 713).—The absorption of oxygen, under the influence of respiring an atmosphere rich in that gas, only increases to a slight amount proportional to the quantity of oxygen which the liquids of the organism dissolve in putting themselves in equilibrium of tension with that of the oxygen of the surrounding air. This equilibrium is rapidly established, so that increase of absorption as rapidly ceases. If the tension of the atmospheric oxygen returns to the normal, the excess of oxygen previously absorbed escapes rapidly for corresponding reasons. W. D. H.

**Respiratory Exchange during the Deposition of Fat.** By MARCUS S. PEMBREY (*J. Physiol.*, 1901, 27, 407—417).—During the autumn, the marmot feeds eagerly on carbohydrate food and rapidly deposits fat in its body as a reserve for combustion during its winter-sleep. The respiratory quotient  $\text{CO}_2 : \text{O}_2$  is greater than unity; the mean of 22 determinations is 1.21, the maximum being 1.39, the minimum 1.04. These high quotients cannot be explained by a reduction in the absorption of oxygen, for, compared with the condition during fasting, there is a considerable increase. The probable explanation is that suggested by Hanriot: during the formation of fat from carbohydrates, a considerable quantity of carbon dioxide is split off from the carbohydrate molecule. W. D. H.

**Influence of Occlusion of the descending Aorta on the Respiratory Exchanges.** By HECTOR RULOT and LÉON CUVELIER (*Trav. du lab. de L. Fredericq, Liège*, 1901, 6, 9—20; from *Arch. de Biol.*, 15, 629).—Bohr and Henriques (*Arch. de physiol.*, 1897) have stated that occlusion of the thoracic aorta exercises no influence on the respiratory exchange; they therefore conclude that the main seat of combustion in the body is not in the tissues and organs of the body, but in the lungs, thus carrying one back to the ideas which prevailed in the time of Lavoisier. The present experiments on dogs show that these ideas have no foundation. The greater the portion of the body shut off from the circulation, the less is the sum total of the respiratory interchanges. At the highest level of occlusion, these were

reduced to a half of the normal. The respiratory quotient rises during occlusion ; after occlusion, it generally falls but sometimes rises.

W. D. H.

**Carbon Dioxide as an Excitant of the Respiratory Centre.** By HECTOR RULOT and LÉON CUVELIER (*Trav. du lab. de L. Fredericq, Liège*, 1901, 6, 1—8 ; from *Arch. de Biol.*, 15, 621).—The symptoms produced by excess of carbon dioxide are very similar to those caused by diminution of oxygen, and some observers doubt whether carbon dioxide is really an excitant of the respiratory centre. The present experiments confirm the classical theory that the gas is an excitant of the respiratory centre, which has also been recently stated to be the case by Zuntz and Loewy (*Arch. f. Physiol.*, 1897, 379—390).

W. D. H.

**Changes in the Composition of Gas injected into the Subcutaneous Tissues.** By LÉON PLUMIER (*Trav. du lab. de L. Fredericq, Liège*, 1901, 6, 77—98 ; from *Arch. de Biol.*, 16, 323).—Gases introduced into the subcutaneous tissues are absorbed especially quickly in the case of those soluble in the blood. Before absorption, the gases tend to put themselves in equilibrium of tension with the blood gases, and this equilibrium is soonest reached in the case of gases which are most soluble in the blood. The oxygen tension in the blood of the subcutaneous region is equal to 6—8 per cent. of an atmosphere, the corresponding number for carbon dioxide is 5 to 8, and for nitrogen 80 per cent. If the gas injected contains a high percentage of carbon dioxide and oxygen, the tension of the oxygen becomes temporarily greater than that of the oxygen of the atmosphere ; this is simply because the carbon dioxide is more rapidly absorbed than the oxygen.

W. D. H.

**The Gases in Blood at Different Altitudes during a Balloon Ascent.** By J. TISSOT and HALLION (*Compt. rend.*, 1901, 133, 1036—1038. Compare this vol., ii, 92).—Experiments made with the blood of a dog during the ascent of a balloon to a height of 3500 metres and its subsequent descent, the results being corrected for the action of air on the collected blood between the time of its withdrawal from the animal and the analysis, show that the power of hæmoglobin to combine with oxygen increases somewhat with a reduction of pressure, at any rate up to the altitude stated. On the level, 100 c.c. contained 15·5 c.c. of oxygen, at 3500 metres, 19·97 c.c., and at 800 metres during the descent, 15·7 c.c. The variations in the quantity of carbon dioxide in the blood are in the opposite direction to those required by the laws of the dissolution of gases, whereas the nitrogen behaves as if it were simply dissolved, 100 c.c. of blood containing 3·25 c.c. at the level and only 0·525 c.c. at 3500 metres. The total quantity of gases contained in the blood increases with the altitude, and the quantities of carbon dioxide and oxygen likewise increase with the altitude. The pressure of the blood in the femoral artery of the dog remained constant throughout the ascent.

C. H. B.



**Sugars of the Blood and Glycolysis.** By RAPHAEL LÉPINE and BOULUD (*Compt. rend.*, 1901, 133, 720—721).—Horse's blood possessing the same reducing power as dog's blood is less dextrorotatory or may even be levorotatory. This is due to conjugated glycuronic acid.

If dog's blood is kept for an hour at 39° while oxygen is passed through it, the fermentable sugar disappears, and the dextrorotatory power decreases or the levorotatory power increases. This is believed to be due to the glycolysis of the sugar, and the appearance of conjugated glycuronic acid. The presence of chloroform somewhat hinders the change.

W. D. H.

**Physiology of the Gill, and Osmotic Pressure of the Blood in the Crayfish.** By LÉON FREDERICQ (*Trav. du lab. de L. Fredericq, Liège*, 1901, 6, 61—63; from *Bull. de l'Acad. roy. de Belg.*, 1898, [iii], 35, 831—833).—The amount of salt in crab's blood can be increased or lessened by altering the amount in the water in which they live. It is quite different in the fresh-water crayfish. Although the gill membrane is so thin, it does not play the inert rôle of a membrane in a dialyser, but is a barrier which effectually separates the internal medium, the blood, from the external, so far as salts are concerned, although it is naturally traversed by the gases of respiration. The osmotic tension of the blood is equal to that exerted by a 1.3 per cent. solution of sodium chloride ( $\Delta = 0.8^\circ$ ); this is higher than is found in vertebrate blood.

W. D. H.

**Artificial Parthenogenesis.** By JACQUES LOEB, MARTIN FISCHER, and HUGH NEILSON (*Pflüger's Archiv*, 1901, 87, 594—596. Compare Abstr., 1900, ii, 608; 1901, ii, 177).—Further experiments in support of those previously published.

W. D. H.

**Artificial Parthenogenesis.** By ARTHUR W. GREELEY (*Amer. J. Physiol.*, 1902, 6, 296—304).—After maturation has been completed, the unfertilised eggs of the starfish, *Asterias forbesii*, can be made to develop regularly into bipinnaria by an exposure to a temperature of 4° to 7° for from 1 to 9 hours. Segmentation of the *Asterias* egg cannot be produced by raising the temperature of the sea-water.

W. D. H.

**Prolongation of the Life of Sea Urchins' Eggs by Potassium Cyanide.** By JACQUES LOEB and WARREN H. LEWIS (*Amer. J. Physiol.*, 1902, 6, 305—317).—The life of the unfertilised eggs of the sea urchin can be materially prolonged by adding to the sea-water a small quantity of potassium cyanide. Sexual as well as parthenogenetic development is prolonged. Lack of oxygen has little or no influence. So long as death is considered as something merely negative (namely, the cessation of life processes), it must appear paradoxical that a deadly poison will prolong life. The paradox disappears if it is assumed that certain active (mortal) processes occur so as to cause death. These specific processes (possibly enzymatic) are in unfertilised eggs checked or modified by sexual or osmotic fertilisation, and also by potassium cyanide, which substitutes for the destructive action of these processes a condition of suspension of life.

W. D. H.

**Eggs of *Rana Temporaria*.** By HEINZ KOLB (*Chem. Centr.*, 1901, ii, 1233; from *Inaug. Diss.-Zurich*, 1901).—The amount of glycogen, water, sulphur, phosphorus, and fat were estimated at different periods during the development of the eggs of the common frog. Glycogen shows periodical variations, being at its minimum when the egg is ripe. Sulphur increases, and phosphorus diminishes, during development; fat shows a slight increase, water a marked one. W. D. H.

**Composition of Egg-Yolk.** By JOHN MALCOLM (*J. Physiol.*, 1901, 27, 356—359).—The percentages of proteid, fat, and phosphorus in the yolk of eggs from the same hen are in close agreement. There are, however, very considerable differences in eggs from a number of hens, even of the same breed. The percentage of lecithin varies considerably. Analytical details are given [compare Thorpe, this vol., ii, 95]. W. D. H.

**The Osmotic Pressure of Dog's Submaxillary Saliva.** By PIERRE NOFL (*Trav. du lab. de L. Fredericq, Liège*, 1901, 6, 225—239; from *Arch de Biol.*, 18).—The osmotic pressure of the submaxillary saliva of the dog, obtained by stimulation of the chorda tympani is variable ( $\Delta = 0.193$ — $0.396$ ). The saliva from the same gland, secreted spontaneously, is more dilute ( $\Delta = 0.109$ — $0.266$ ). The tension is due all but exclusively to the salts of the saliva. The osmotic tension rises when the duct is obstructed; this is explicable by supposing that absorption of water occurs in the excretory tubules. W. D. H.

**Conversion of Pancreatic Zymogens into Enzymes.** By HORACE M. VERNON (*J. Physiol.*, 1901, 27, 269—322).—Extracts of fresh pancreas show usually no ferment activity for some days, and then suddenly develop nearly their maximum power. After maintaining this power for some days or weeks, they gradually deteriorate. When the glands from several animals are minced together and extracted, the ferment activity begins to develop at once. As regards trypsin, glycerol extracts are the most powerful; the rennetic value is but little influenced by the nature of the extracting liquid. As a rule, however, tryptic and rennetic values vary together. Diluting glycerol extracts with water develops tryptic power increasing with the degree of dilution. The conversion of zymogens with enzyme is enormously increased by the addition of an active extract. It is the tryptic ferment which liberates both the ferments. The products of tryptic digestion have the same power to a less degree. Bubbling oxygen or carbon dioxide through the glycerol extract at  $38^{\circ}$  has no influence, but if active extract is added as well, oxygen increases, and carbon dioxide diminishes, enzyme formation. In order to obtain an active tryptic extract, the plan advised is to use pig's pancreas, and extract it with 50—75 per cent. glycerol and test its proteolytic power every few days. After it has risen considerably, and before much auto-digestion has occurred, the glycerol should be filtered off and kept separate. Its activity would still further increase, and then remain nearly constant for months and perhaps years. One part of the

finely minced gland, and four parts of the extracting liquid by volume should be employed.

W. D. H.

**Production of the Tryptic Ferment from its Zymogen.** By HENRY F. BELLAMY (*J. Physiol.*, 1901, 27, 323—335).—The dog's pancreas presents two phases of activity; (1) a slow and continuous one, feebly evident after digestion, and reaching its height during complete fast; during this period, the principal material in the gland cells is zymogen; (2) a rapid and intermittent phase coincident with the period of gastric activity, in which, as advocated by Herzen, the inactive zymogen receives an 'internal secretion' from the spleen, which liberates the trypsin. The blood is the vehicle by means of which this is conveyed to the pancreas; it is not present in the serum; if it is in the plasma, it is destroyed when the blood clots; it probably is conveyed by the blood corpuscles. If a dog is deprived of its spleen, no trypsin is formed, but trypsinogen continues to be formed and is secreted as such; it can, however, be rendered useful by subsequent conversion into trypsin by an agency other than splenic, namely, by the secretion of the mucous membrane of the small intestine, especially of the jejunum.

W. D. H.

**Proteolytic Enzyme of the Thymus.** By FR. KUTSCHER (*Zeit. physiol. Chem.*, 1901, 34, 114—118).—The thymus gland contains a proteolytic enzyme, which leads to auto-digestion in extracts of the gland. Among the products of proteolytic action, ammonia and lysine are found; arginine, aspartic acid, glutamic acid and tyrosine are absent. The presence of histidine and leucine is doubtful. Whether this action is due to trypsin, or to another hitherto unknown enzyme, is for the present left uncertain.

W. D. H.

**Nutrition of the Suckling Infant.** By KARL OPPENHEIMER (*Zeit. Biol.*, 1901, 42, 147—160).—The varying needs of an adult for food are comparatively easy to understand. It is more difficult to realise why infants during suckling, in which the amount of muscular exercise is uniformly small, should also take different amounts of food. The amount of milk taken may be ascertained by weighing the child before and after each meal. In cases previously recorded, the total milk sucked during the first ten weeks of life varies from 30 to 53 kilograms. In the present paper, careful observations are given in connection with a child prematurely born at the eighth month, and the results are compared with the figures previously given by others, and an attempt made to find a general rule to account for the variations. In two children, there was a constant relation between amount of food and body weight, but this does not hold throughout. The constant relationship is between food and body surface (Rubner's law).

W. D. H.

**Energy Value of Diet in Man.** By MAX RUBNER (*Zeit. Biol.*, 1901, 42, 261—308).—A general view is given of the author's well known work on this subject. The nutrition value of a few important food stuffs is as follows: meat, 76·8; bread, 82·1; milk, 89·8; potatoes,

92.1. These numbers are the percentage of the total energy available for use in the body. These and other numbers are employed to reckon the value of mixed dietaries. The facts given are mainly statistical.  
W. D. H.

**The Physiological Significance of Salt.** By LÉON FREDERICQ (*Trav. du lab. de L. Fredericq, Liège*, 1901, 6, 64—66; from *Bull. de l'Acad. roy. de Belg.*, 1898, [iii], 35, 834—836).—Bunge states that sodium chloride is chiefly used by those who take abundance of vegetable food in order to combat the harmful influence of potassium salts which predominate in vegetables and which would otherwise tend to replace the sodium salts of the blood and tissues. Lapique, on the other hand, believes that the function of salt is simply to accentuate the flavours of foods, and that this purely gustative action can equally well be carried out by salts of other metals. The observations recorded in the present paper support the latter view. An examination of the salt prepared by the natives of the Congo State by burning aquatic plants show it to consist mainly of potassium chloride and sulphate.  
W. D. H.

**Action of Alcohol on Man.** By R. O. NEUMANN (*Arch. Hyg.*, 1901, 41, 85—118).—Polemical against Rosemann. The author maintains his original contention that alcohol acts as a proteid-sparer. W. D. H.

**The Value of Rhamnose in the Animal Organism.** By MAX CREMER (*Zeit. Biol.*, 1901, 42, 428—467).—The paper is largely concerned with theoretical considerations on carbohydrate metabolism. One of the most important is the assertion, which rests on experimental proofs, that proteids which are free from a carbohydrate radicle do not lead to glycogen formation. Rhamnose does not lead to glycogen formation, but comparatively small amounts leave the body as such. It has a calorific value, and its combustion leads to a sparing effect on other constituents of the body, especially of fat. Numerical data of experiments on one dog and four rabbits, mainly relating to gaseous metabolism, are given.  
W. D. H.

**The Origin of Glycogen from Proteid.** By BERNHARD SCHÖNDORFF (*Pflüger's Archiv*, 1901, 88, 339—345).—Polemical. A reply to Cremer.  
W. D. H.

**Behaviour of Xylan in the Animal Body.** By B. SLOWTZOFF (*Zeit. physiol. Chem.*, 1901, 34, 181—193).—In rabbits, if xylan is given with the food, part is absorbed (33 to 83 per cent.), and the remainder passes away with the faeces. A small portion (1.5 to 4.6 per cent.) of that which is absorbed appears in the urine; the rest is used by the organism, although it is uncertain if this has any nutritive value. The urine contains a furfuraldehyde-forming substance of undetermined composition. If the animal is killed a short time after injection of xylan, that material is found in the blood, liver, and muscles. Xylan undergoes putrefaction, but not so readily as xylose; its destruction in the intestines by putrefactive agencies is improbable.  
W. D. H.



**Changes in the Carbohydrates in the Body of Ascaris.** An Animal Fermentation Process. By ERNST WEINLAND (*Zeit. Biol.*, 1901, 42, 55—90).—The author has previously called attention to the large amount of glycogen in the body of various parasitic worms. It often amounts to from a third to nearly a half of the total dry material. The present experiments were made on the common round worm *Ascaris*. This animal requires no free oxygen, and can be kept alive in boiled saline solution for several days; bubbling oxygen through the salt solution does not prolong its life; but bubbling carbon dioxide through the solution almost doubles its period of life. The daily loss per 100 grams of body weight is 0.7 gram of glycogen, 0.1 gram of dextrose, and 0.07 gram of nitrogen. The relative amount of water to solids increases, but the fat undergoes practically no change. The normal alkalinity of the animal's tissues diminishes, and may even be replaced by faint acidity. The daily production of carbon dioxide (during hydrogen respiration) is 0.38 gram per 100 grams of body weight. The animal acquires a rancid odour, and this is due to two fatty acids, butyric and valeric, 0.3 gram of valeric acid being produced daily for every 100 grams of body weight; this is not due to micro-organisms, but is a product of the animal's metabolism. The nitrogen found in the salt solution in which the animal lives amounts to 0.0015 gram per 100 grams of body weight daily; the form in which the nitrogen leaves the body was not ascertained. On comparing the loss of weight to the products excreted, the former is found to be the greater; probably some of the lost material is used in the production of ova and spermatozoa. Provisional formulæ are given to account for the breakdown of carbohydrate material. Particular attention is drawn to the fact that this breakdown is not oxidation, but an action of a fermentative nature similar to that which occurs in certain micro-organisms and fungi.

W. D. H.

**Formation of Fat from Carbohydrate.** By KARL B. LEHMANN and ERWIN VOIT (*Zeit. Biol.*, 1901, 42, 619—671).—The experiments show that a carbohydrate diet causes a considerable but variable putting on of carbon in the body.

W. D. H.

[**Fat Absorption.**] By EDUARD PFLÜGER (*Pflüger's Archiv*, 1901, 88, 299—338, 431—452).—These are two further contributions to a much debated question. Details are given regarding the melting points of fatty mixtures; the existence of a form of oleic acid in horse's fat with a high iodine number; the solubilities of fats and fatty acids in various mixtures of bile and sodium carbonate; the importance of sodium carbonate for the bringing of oleic and other fatty acids into a form which is soluble in water; the importance of the bile circulation both for the digestion and absorption of fat, and, in the second paper, the importance of the presence of soaps for enabling fatty acids to enter into solution.

W. D. H.

**The Physiological Proteid Minimum.** By MAX CREMER and M. HENDERSON (*Zeit. Biol.*, 1901, 42, 612—617).—Two experiments are described on dogs, which are similar to those performed by E. Voit

and Korkunoff (*Zeit. Biol.*, 32, 58). The extreme values given by these authors were not obtained.  
W. D. H.

**Proteid Metabolism.** By MAX GRUBER (*Zeit. Biol.*, 1901, 42, 407—427).—The subject of proteid metabolism is treated mainly from the theoretical standpoint; Pettenkofer and Voit's old distinction between the organ proteid, which undergoes but little and that a constant change, and the proteid derived directly from the food, which is subject to great variations, is insisted on. The influence of water in increasing the excretion of waste nitrogenous products, and the fact that different proteids after absorption vary in their yield of katabolic products, are supported by experiments.  
W. D. H.

**Decomposition of Proteids in Men during the Performance of Hard Work.** By C. JACKSON (*Atti Real. Accad. Lincei*, 1901, [v], 10, ii, 186—188).—The author has compared the urine of five persons while at rest and while undergoing vigorous exercise on a mountain climb. The results are given in the following table: (1) was a porter of 35 years; (2), (3), and (4) men of 26, 32, and 62 years respectively; and (5) a youth of 17 years:

	Specific gravity.		Total nitrogen.		Nitrogen as urea and ammonia.		Ratio of nitrogen as urea and ammonia to total.	
	Resting.	Working.	Resting.	Working.	Resting.	Working.	Resting.	Working.
(1)	1024	1023	0.78	1.28	0.65	0.99	0.83	0.77
(2)	1023	1028	1.41	1.65	1.13	0.92	0.80	0.56
(3)	1024	1024	1.14	1.79	0.94	1.18	0.82	0.66
(4)	1021	1026	1.43	1.65	1.27	0.69	0.88	0.42
(5)	1023	1030	1.51	2.11	1.32	1.82	0.87	0.86

Thus in all cases, more nitrogen was eliminated in the urine during work, a fact perhaps depending to some extent on the increased amount of food taken; (1) and (5) ate very well, whilst (4) took scarcely any food. Except for (5), the proportion of the total nitrogen present as urea was diminished by working. It is probable that fatigue is a pathological condition in which the matter eliminated from the body is not only increased, but changes in a manner that indicates a solution of the tissues, probably of the muscles. By exercise, the same work becomes possible without destruction of the muscles.  
T. H. P.

**The Change produced in Albumoses by the Gastric Mucous Membrane.** By KARL GLAESSNER (*Beitr. chem. Physiol. Path.*, 1901, 1, 328—338).—A regeneration of proteid from its hydrolytic products occurs in the gastric mucous membrane; this, however, relates exclusively to the albumoses. The change in the dog commences soon after

digestion starts, reaches its maximum five or six hours later, and then subsides. This power of proteid synthesis is a property of the mucous membrane. It is not considered that rennin plays any part in the process; the formation of plastein by rennin *in vitro* is probably not analogous to what occurs *in vivo*. W. D. H.

**Nutritive Value of Gelatin.** By OTTO KRUMMACHER (*Zeit. Biol.*, 1901, 42, 242—260).—The heat-value of gelatin, as obtained by the use of the calorimeter, was found to be 5·3676 Cal. in one preparation, 5·3779 in another. In order to obtain its physiological heat value, several deductions have to be made, principally for unburnt products in urine and faeces; after the deductions, the heat value is 3·8835 Cal., or 72·35 per cent. of the total energy; Rubner's numbers for meat and proteid are 74·9 and 76·8 per cent. respectively. In experiments on dogs, the proteid decomposition during gelatin feeding is 62·6 per cent. of that which is broken down during inanition. This probably represents the maximal action of gelatin. In a man of mean body weight, the amount of proteid which undergoes katabolism per diem is 70 grams. If gelatin is given to exert the maximal effect, it being assumed that the same relationship holds for man as for dogs, 33 grams of gelatin will reduce the katabolised proteid to 56 grams, or 33 grams of gelatin will spare 14 grams of proteid. W. D. H.

**The Nutritive Value of Meat and Meat Preparations in Man.** By WILHELM PRAUSNITZ (*Zeit. Biol.*, 1901, 42, 377—406).—A research carried out in the usual manner, in which the utility of various forms of meat food is compared. The main result is that fresh meat cooked in the usual way is much more easily digested than various preparations in which drying of the meat is part of the method employed. Roast fresh meat is almost entirely absorbed, and leads to only a small formation of faeces. Among the various patent preparations, there are differences, but in every case the amount of faeces is large, and contains much unused nutriment. W. D. H.

**The Place of Purine Substances in Metabolism.** By OTTO LOEWI (*Pflüger's Archiv*, 1901, 88, 296—298).—Polemical against Burian and Schur (this vol., ii, 33). W. D. H.

**Relationship of Iron and Pigments in the Liver and Skin.** By N. FLORESCO (*Compt. rend.*, 1901, 133, 828—830).—From observations made at first on snails, but later on dogs, cats, and rabbits, the conclusion is reached that there is a relation between the liver and the skin and also the fur, in point of view of the amount of iron and of pigments. The liver, and the skin of dark-coloured animals contain nearly double the quantity of iron and of pigment which those with white fur possess. Intermediate cases occur in those lightly-coloured. W. D. H.

**The Ammonia removing Function of the Liver.** By ARTHUR BIEDL and HEINRICH WINTERBERG (*Pflüger's Archiv*, 1901, 88, 140—199).—The statement made by previous observers that the blood

entering the liver contains more ammonia than that which leaves it is confirmed. The power of the liver to remove ammonia is in the present research investigated on animals which have been poisoned by ammonia and certain ammonium salts. In some experiments, the liver was thrown out of gear by an Eck's fistula. The liver appears to be able to cope with increased quantities of ammonia produced in certain pathological states; the proof is not, however, clear that this alone will explain the autointoxication produced when the liver is thrown out of the circulation.

W. D. H.

**Formation of Free Iodine from Iodoform.** By FRITZ ALTENBERG (*Chem. Centr.*, 1901, ii, 1212; from *Arch. int. Pharmacodyn. Ther.*, 8, 106).—Urine, blood, and pus cannot decompose iodoform with the formation of free iodine. Cellular organs in the absence of micro-organisms can do so, however; this power is especially found in secreting glands, particularly the testis.

W. D. H.

**Formation of Ethereal Sulphate in the Animal Body.** By GUSTAV EMBDEN and KARL GLAESSNER (*Beitr. chem. Physiol. Path.*, 1901, 1, 310—327).—The experiments were performed on dogs by the perfusion method. The liver was found to be the principal place where the synthesis leading to the formation of ethereal sulphates takes place. They are not formed by the muscles or intestine, but small quantities are manufactured by the kidneys and lungs.

W. D. H.

**Effect of Freezing on Milk.** By FRED. BORDAS and SIG. DE RACZKOWSKI (*Compt. rend.*, 1901, 133, 759—760).—On freezing milk, the upper portion of the block is soft and contains most fat; the peripheral portion is transparent; the centre forms a white nucleus and is chiefly casein and sugar; the lower portion contains even a larger proportion of casein and sugar. The following are the analyses (per cent.) of the four portions:

	Peripheral.	Upper.	Central.	Lower.
Ash .....	0.46	0.61	2.10	2.78
Fat .....	1.54	21.68	1.58	0.79
Lactose.....	2.81	3.52	10.64	18.65
Casein .....	1.72	6.40	12.43	19.31

W. D. H.

**The Diurnal Curve of Sweat Formation.** By LÉON FREDERICQ (*Trav. du lab. de L. Fredericq, Liège*, 1901, 6, 209—212).—By determinations on the author's own person, it is shown that the curve of sweat formation in the day very accurately follows that of the diurnal changes of temperature. The increased formation of sweat during muscular activity is mainly due to elevation of the internal body temperature. The rise of temperature acts on the nervous centres concerned in the process.

W. D. H.

**Estimation of Acidity in Urine.** By ROBERT ARNSTEIN (*Zeit. physiol. Chem.*, 1901, 34, 1—27).—The methods investigated were those



of Freund-Lieblein and of Jäger. The influence of various salts on the acidity is also studied. Further investigation in order to find an accurate method is promised.

W. D. H.

**Investigation of Fæces.** By HANS URY (*Chem. Centr.*, 1901, ii, 1233—1234; from *Deutsch. med. Woch.*, 27, 718—723).—The paper mainly relates to methods, and especially to those which have for their object the estimation of nitrogen, phosphorus, and nuclein in the fæces.

W. D. H.

**Reactions of Infusoria with Carbonic and other Acids.** By HERBERT S. JENNINGS and E. M. MOORE (*Amer. J. Physiol.*, 1902, 6, 233—250).—Many infusoria collect in solutions of carbon dioxide and other acids, just as *Paramœcium* does. The spontaneous collections formed by these organisms may therefore be due to their excretion of carbon dioxide; nevertheless there are other infusorians which, although they form spontaneous collections, do not gather in acids, and others still which undoubtedly produce carbon dioxide, but do not form spontaneous collections at all.

W. D. H.

**Transformation of Glycerol into Sugar by Testicular Tissues.** By GABRIEL BERTRAND (*Compt. rend.*, 1901, 133, 887—890).—The testicular tissues, obtained under aseptic conditions from the dog, rabbit, guinea-pig, and cock, do not transform glycerol, in 10 per cent. aqueous solution, into a reducing sugar. The change is brought about by the addition of a trace of a solution containing microbes. The sugar obtained under these conditions reduces Fehling's solution in the cold and is identical with dihydroxyacetone yielding the osazone melting at 130° (compare Berthelot, *Ann. Chim. Phys.*, 1857, 369).

G. T. M.

**Cyclic Terpenes and Camphor in the Animal System. I.** By EMIL FROMM and HERMANN HILDEBRANDT (*Zeit. physiol. Chem.*, 1901, 33, 579—594. Compare Schmiedeberg and Meyer, *ibid.*, 3, 422; Pellacani, *Arch. exp. Path. and Pharm.*, 1883, 17, 376; Schmiedeberg, *ibid.*, 1881, 14, 308; Rimini, *Rend. Accad. Lincei.*, [v], 10, 244).—Cyclic terpenes and camphors are transformed in the animal system, by a process of oxidation or hydration, into monohydroxyl derivatives, which are eliminated in the form of glycuronic acid derivatives.

When a hydroxyl group is already present, as in sabinol, the compound of the original substance with glycuronic acid is eliminated. Pinene yields *pinenolglycuronic acid*, but neither acid nor salts have been obtained in a crystalline form; on treatment with hydrochloric acid, it yields a hydrocarbon,  $C_{10}H_{14}$ , boiling at 175—176°.

*Phellandrenolglycuronic acid* and its salts are non-crystalline and when hydrolysed yield a *phenol*,  $C_{10}H_{14}O_2$ , melting at 142°, and a hydrocarbon,  $C_{10}H_{14}$ , distilling at 175°.

*Camphenolglycuronic acid*, on hydrolysis, yields camphenol,  $C_{10}H_{15}\cdot OH$ , boiling at 202—204°.

*Sabinenolglycuronic acid* yields cymene on hydrolysis, and on oxidation, gives a mixture of two acids, the one melting at  $220^{\circ}$ , and the other remaining solid even at  $320^{\circ}$ .

*Sabinolglycuronic acid*, on hydrolysis, yields cymene and on oxidation gives benzoic acid together with an acid,  $C_{11}H_{10}O_4$  or  $C_{14}H_{14}O_5$ , melting at  $198^{\circ}$ .

*Thujonehydrateglycuronic acid* yields a crystalline *potassium salt*,  $C_{16}H_{25}O_8K$ , which on hydrolysis yields glycuronic acid and a *hydrocarbon* boiling at  $170-180^{\circ}$ .  
J. J. S.

**Borneol- and Menthol-glycuronic Acids.** By A. BONANNI (*Beitr. chem. Physiol. Path.*, 1901, 1, 304—309).—In dogs, if borneol is given by the mouth, it is excreted in the urine in combination with glycuronic acid. The same is true for menthol.

Borneolglycuronic acid,  $C_{16}H_{26}O_7 \cdot H_2O$ , which crystallises in needles, is soluble in water, alcohol, ether, acetone, or chloroform; when boiled with dilute sulphuric acid, it is resolved into its components. The potassium, zinc, and copper salts are crystalline, the calcium and barium salts amorphous.

Mentholglycuronic acid was only obtained as a syrup, neither could crystalline salts be obtained.  
W. D. H.

**Certain Biological Characters of Phenylhydrazine.** By LOUIS LEWIN (*Zeit. Biol.*, 1901, 42, 107—146).—Chemists who work much with phenylhydrazine suffer from ill-health, of which the most prominent sign is a kind of eczema. The substance is also poisonous to animals, and the pathological signs produced are described in full. Particular attention is directed to the action on the blood; especially on living blood; here a green derivative of hæmoglobin, called hæmo-verdin, is produced (compare this vol., i, 67).  
W. D. H.

**Metabolism in Acute Gout.** By HANS VOGT (*Chem. Centr.*, 1901, ii, 1212; from *Arch. klin. Med.*, 71, 21—28).—In gout, there is retention of nitrogen, which is not due to putting on of flesh. It appears to be explained by katabolism of nuclein, the phosphorus of which is excreted and the nitrogen retained. Whether this is purine nitrogen or proteid nitrogen must be decided by further work on the fate of uric acid and purine during the gouty condition. If nuclein is given in the food, it appears to be absorbed and excreted normally, the phosphorus soon, the uric acid later.  
W. D. H.

**Peptone in the Urine.** By MIDORI ITO (*Chem. Centr.*, 1901, ii, 1212—1213; from *Arch. klin. Med.*, 71, 29—36).—Some rare cases are described in which true peptone (in Kühne's sense) was found in the urine. The cases were those of lung disease.  
W. D. H.

**Alcaptonuria.** By FRANZ MITTELBACH (*Chem. Centr.*, 1901, ii, 1213; from *Arch. Klin. Med.*, 71, 50—72).—The theory that alcapton originates from tyrosine is confirmed. Phenylpropionic acid does not influence the excretion, phenylacetic acid does. In the estimation of alcapton, it is necessary to remove the uric acid first by saturation with ammonium chloride.  
W. D. H.

**Compounds of Arsenic in the Human Liver.** By RICHARD VON ZEYNEK (*Chem. Centr.*, 1901, ii, 1232; from *Centr. f. Physiol.*, 15, 405—408).—In arsenic poisoning (two cases), arsenic was found in a 0.1 sodium carbonate extract of the liver and in the insoluble residue after extraction with 10 per cent. solution of sodium chloride. After peptic digestion, the arsenic is found in the insoluble residue [Slowtzoff made similar observations (this vol., ii, 34)]. W. D. H.

**Excretion of Cacodylic Acid and its Detection in Cases of Poisoning.** By DIOSCORIDE VITALI (*Chem. Centr.*, 1901, ii, 1212; from *Boll. Chim. Farm.*, 40, 657—665).—Cacodylic acid is sometimes used therapeutically; it passes as such into the urine, and not in an organic compound. A method of detecting it in the urine is described. W. D. H.

**The Influence of Carbon Monoxide on the amount of Carbon Dioxide in Arterial Blood.** By T. SAIKI and G. WAKAYAMA (*Zeit. physiol. Chem.*, 1901, 34, 96—107).—The experiments were made on rabbits and dogs. Under the influence of carbon monoxide poisoning, the amount of oxygen and carbon dioxide in the blood is greatly diminished; the amount of lactic acid increases. Amyl nitrite has the same effect on the carbon dioxide. W. D. H.

**The Influence of Certain Poisons on the Synthesis of Phenol-sulphuric Acid in the Animal Organism.** By K. KATSUYAMA (*Zeit. physiol. Chem.*, 1901, 34, 83—95).—In rabbits, poisoning with carbon monoxide produces an increase of the combined sulphates. The reaction of the urine, which is normally alkaline in these animals, becomes acid or neutral. Amyl nitrite inhibits the formation of phenol-sulphuric acid. W. D. H.

**Metabolism during Curare-poisoning.** By OTTO FRANK and FRITZ VOIT (*Zeit. Biol.*, 1901, 42, 309—362).—Metabolism pursues the same course when the muscular system is rendered inactive by curare. Large doses of curare upset metabolism, mainly by paralysing the muscular portion of the circulatory system and lowering blood-pressure; the lessening of the metabolism which then occurs is partly due to lowering of the body temperature. When a moderate dose is given so that only the voluntary muscles are affected, metabolism is so regular that the smallest changes produced by other agencies are markedly noticeable.

The total metabolic exchanges are probably in the main greater in a curarised animal than in one simply at rest, in order to maintain the normal body temperature. Curarised animals, except during lactation, follow Rubner's law of a fixed relationship between surface area and the amount of katabolism. About 85 per cent. of the total heat produced comes from fat metabolism. The metabolism both of proteid and fat in curarised, and in absolutely resting animals, is almost the same as under normal conditions. W. D. H.

**Toxicological Studies on the Selachian Heart.** By WALTHER STRAUB (*Zeit. Biol.*, 1901, 42, 363—376).—Observations are recorded

regarding the action of antiarin and strophanthin on the heart of the ray, dogfish, and other selachians, and the results compared with those found in experiments with the frog's heart (*Arch. exp. Path. Pharm.*, 1901, 45, 346).

These digitalis glucosides show, towards the fishes' heart, a smaller toxicity than in the frog; the effect on auricle and ventricle is about equal.

W. D. H.

**Ergot of Rye.** By MARCEL GUÉDRAS (*Compt. rend.*, 1901, 133, 1314).—The therapeutic action of ergot of rye is due to sphacelinic acid, cornutine, and the salts formed by their combination. Their separation presents great difficulty because their solubilities are practically equal. A good sample of ergot should contain a high percentage of sphacelinic acid and cornutine, and a low percentage of sclerotic acid and other inert substances.

C. H. B.

**Physiology of the Hypophysis.** By E. VON CYON (*Pflüger's Archiv*, 1901, 87, 565—593).—Hypophysin (not chemically identified) is placed with thyroiodin and suprarenin (or epinephrin) as a physiological heart poison. Removal of the hypophysis interferes with general metabolism, and produces not only acromegaly but also sterility. The main part of the paper has but little chemical interest.

W. D. H.

**Phloridzin Diabetes.** By GRAHAM LUSK (*Zeit. Biol.*, 1901, 42, 31—44. Compare Abstr., 1900, ii, 558).—In phloridzin diabetes, no sugar originates from fat. The number of calories which are lost by the excretion of sugar are made good by the increased decomposition of proteid. The relationship between dextrose and nitrogen in the urine of the fasting phloridzin diabetic dog is 3.75 : 1; in the rabbit, goat, and cat, it is 2.8 : 1.

W. D. H.

**The Influence of Valency in the Antitoxic Action of Ions.** By JACQUES LOEB (*Pflüger's Archiv*, 1901, 88, 68—78).—The poisonous action of ions differs for various embryos and for different forms of contractile tissue. Certain other ions have an antagonistic action. The antitoxic action is confined to cations, and in this relation valency is a factor of importance. The poisonous action of a univalent cation can be neutralised by minimal quantities of a bivalent, and probably still smaller quantities of a tervalent, cation. The toxic action of a bivalent cation can be neutralised by a small quantity of another bivalent, or a relatively larger quantity of a univalent cation.

W. D. H.

**Natural Immunity against Alkaloids.** By ALEXANDER ELLINGER (*Zeit. Biol.*, 1901, 42, 228—241).—It is well known that certain animals are not affected by poisonous alkaloids. The rabbit in relation to atropine is one of the best known examples. Calmette has, however, shown that if 2 milligrams of atropine sulphate are injected directly into the brain of a rabbit, it dies in a few hours; yet it is unaffected by 0.2 gram injected into its blood. He believes the leucocytes of



this animal have the power of combining with the alkaloid and so protecting the animal. It is now pointed out that this theory is not supported by analyses of leucocytes, plasma, and brain, and that there is a want of certain control experiments. Attempts to show that the leucocytes contain more atropine than the plasma were not successful, although it is admitted that the methods of estimation of minute quantities of the alkaloid are not at present very accurate. W. D. H.

**Protective Substances of Immune Sera.** By E. W. AINLEY WALKER (*J. Hygiene*, 1902, 2, 85—100).—From experiments with *Bacillus typhosus*, conclusions are reached which differ somewhat from Ehrlich's, especially in relation to the part played by the 'addiment.' The amount of the 'immune substance' needed for protection against  $n$  minimum lethal doses of a bacterium is contained in  $(nd - e)/(d - e)$  c.c. of its immune serum, where  $d$  is the minimum lethal dose, and  $e$  the largest dose, invariably not fatal, and the serum equivalent of one minimum lethal dose. The addiment is a leucocytic ferment which is not extremely special to the species, and is increased during and by immunisation. Agglutinins assist the phagocytic process of ingestion. W. D. H.

**Immune Substances.** By ERNST P. PICK (*Beitr. chem. Physiol. Path.*, 1901, 1, 351—444).—This is an attempt to isolate various 'immune substances' of the antitoxic blood in various diseases. They are associated with the globulin of the serum, usually with the euglobulin fraction. The property of preventing the action of 'coagulins' is also possessed by euglobulin, whilst antirennin action is a property of pseudo-globulin. Calcium salts and phosphates have no influence on the former action. W. D. H.

## Chemistry of Vegetable Physiology and Agriculture.

**Nitrogen-assimilating Bacteria in Soils.** By P. NEUMANN (*Landw. Versuchs-Stat.*, 1901, 56, 203—206).—Extracts of the above-ground portions of *Vicia faba*, of the roots (both previously extracted by heating with water for 24 hours on a water-bath), and of peaty soil were inoculated with an extract of bean roots, of the nodules, and of the adhering soil, as well as with the crushed roots and nodules themselves, and with an extract of the stems and leaves. Assimilation took place in each case during the two weeks which the experiments lasted, and the effect of the three methods of inoculation was very similar. The greatest assimilation took place in the extract of stems and leaves, whilst in peat extract it was very much more restricted. Assimilation depends, therefore, essentially on the organic food at the disposal of the microbes.

The same minerals were added to all the cultivations.

N. H. J. M.

Process for Inoculation with Soil Bacteria. By FR. BAYER & Co. (*Bied. Centr.*, 1902, 31, 12—14; from *Bl. Zuckerrübenbau*, 1901, 217).—A new bacillus, described as "Alinit-Bacillus Beta," to distinguish it from the ordinary alinit bacillus (Alpha) is described, which is obtained from humous soils which have responded to the application of alinit. Such soils are found to contain considerable amounts of furfuroids.

It was found that in every soil on which increased yields of cereals were obtained after applying alinit, the original alinit bacillus was accompanied by the new bacillus. The latter does not alone assimilate free nitrogen, but it increases the assimilating power of ordinary alinit.

The simultaneous action of the two bacilli was found to benefit, not only cereals, but all other crops.

It is desirable to add to the soil a certain amount of carbohydrate (solution of molasses, for instance) when employing alinit.

N. H. J. M.

Alcoholic Fermentation of the Must of Indian Figs. By C. ULPANI and L. SARCOLI (*Gazzetta*, 1901, 31, ii, 395—413).—The authors have studied the alcoholic fermentation of the must of the Indian fig which is largely grown in the southern parts of Italy, with a view to the commercial production of alcohol. The juice expressed from the crude fig pulp is found to contain 12·8 per cent of sugar. When left to itself, the must undergoes spontaneous fermentation by means of a special organism to which the name *Saccharomyces Opuntiae* is given. The authors have studied the morphological and biological characters of this yeast, which does not liquefy gelatin or starch paste, has no action on sucrose or maltose, and produces no pigment of any kind. It ferments dextrose and laevulose, but exerts no action on lactose, raffinose, galactose, mannitol, or dulcitol. Comparative experiments have been carried out on the fermentation of sterilised Indian fig must by means of *Saccharomyces Pastorianus II.* and *S. Opuntiae*, the results being shown briefly in the following table, all the numbers representing grams.

	Sugar in must.	Alcohol (calc.).	Alcohol (found).	CO <sub>2</sub> (calc.).	CO <sub>2</sub> (found).	Sugar remaining.
<i>S. Opunt.</i> .....	19·8	10·12	5·62	9·6800	5·4664	0·9500
<i>S. Past. II.</i> .....	19·8	10·12	8·21	9·6800	10·3992	traces

It will thus be seen that *S. Pastorianus II.* gives a yield of alcohol which nearly approaches the theoretical amount and far exceeds the quantity obtained with *S. Opuntiae*. The spontaneous fermentation of the must of the Indian fig is thus badly adapted for the production of alcohol and the authors find that if the unsterilised must is inoculated with *S. Pastorianus II.*, the latter organism is very quickly checked by spontaneous inoculation and growth of *S. Opuntiae*. The investigations

are being continued in the hope of discovering a yeast which will not be checked by *S. Opuntiae* and will yield a large proportion of alcohol.  
T. H. P.

[Yeast Trypsin.] By ERNST SALKOWSKI (*Zeit. physiol. Chem.*, 1901, 34, 158—161).—Polemical. A reply to Kutscher (*Abstr.*, 1901, ii, 523).  
W. D. H.

Physiological Action of Formaldehyde. By WALDEMAR KOCH (*Amer. J. Physiol.*, 1902, 6, 325—329).—Experiments on yeast lead to the conclusion that formaldehyde does not act by the formation of active oxygen or by destroying the zymase, but brings about the death of the cell indirectly by rendering its proteid food supply useless, and by preventing the digestion of proteids always going on within the body of the cell. Similarly, the conclusion is drawn in connection with experiments in pancreatic digestion that the enzyme is not directly affected by formaldehyde. The harmful action is on the proteid substances on which trypsin acts, these being rendered indigestible by the formaldehyde, in proportion to its strength and the time of exposure.

W. D. H.

Chlorophyllous Assimilation. By M. HARROY (*Compt. rend.*, 1901, 133, 890—891. Compare Friedel, *Abstr.*, 1901, ii, 411).—The chlorophyll contained in extract of spinach has no action on carbon dioxide in direct sunlight; the assimilation does not appear to take place outside the living organism.

G. T. M.

The Proteolytic Enzyme of *Nepenthes*. By SIDNEY H. VINES (*Ann. Bot.*, 1901, 60, 563—573).—Although in the main the conclusions of Clautriau on the digestive process in pitcher plants are confirmed, one of them is disputed. Clautriau believes that nepenthin most nearly resembles pepsin in its action. It is admitted that nepenthin is most active in acid media, nevertheless tryptophan occurs in the digestive products; this is regarded as the most distinguishing characteristic of tryptic digestion. Tryptic digestion appears to be the more primitive form of the digestive process.

W. D. H.

Variations in the Organic Matter during Germination. By GUSTAVE ANDRÉ (*Compt. rend.*, 1901, 133, 1229—1231).—The cotyledons lose fat whilst the seedlings acquire fat, probably in part by the transformation of carbohydrates. The carbohydrates soluble in alcohol disappear very quickly at first from the cotyledons, but not afterwards, whilst no regular increase takes place in the plants. The cotyledons also lose the saccharifiable carbohydrates, at first very rapidly, but afterwards more slowly; simultaneously there is a gain in the plants. Cellulose probably takes no part in feeding the young plant. Vasculose increases rapidly in the plant, and the amount produced is relatively greater than the amounts of saccharifiable carbohydrates and cellulose. The total nitrogen decreases in the cotyledons, and migrates to the plants.

N. H. J. M.

Can Leucine and Tyrosine serve as Nutrients for Plants? By ERNST SCHULZE (*Landw. Versuchs-Stat.*, 1901, 56, 97—106).—After referring to negative results obtained by Lutz (*Ann. Science Nat.*, 1899, [vi],

*Bot.*, 7, 1—103), attention is drawn to the fact that both leucine and tyrosine seem to disappear during growth (*Zeit. physiol. Chem.*, 24, and 30; and Shibata, *J. Coll. Science Imp. Univ. Tokio*, 1900, 13, Part 3). The conclusion is drawn that both substances are assimilated by phanerogams. Loew and Bokorny (*J. pr. Chem.*, 1887, [ii], 36, 279) have shown that algæ utilise leucine. N. H. J. M.

**Blue Coloration of certain Mushrooms.** By GABRIEL BERTRAND (*Compt. rend.*, 1901, 133, 1233—1236).—When certain mushrooms of the genus *Boletus* are broken, their tissues rapidly acquire a blue colour which disappears in a few minutes (Schönbein, *Phil. Mag.*, 1856 [iv], 11, 137; Bertrand and Bourquelot, *Compt. rend. Soc. Biol.*, 1895 [x], 2, 579—582).

The chromogen, *boletol*, which the author has now isolated has the character of an acid phenol. Solutions of boletol in pure water show the blue coloration only with difficulty when treated with laccase, but the coloration is readily obtained in solutions of potassium boletate or by adding to boletol an alkali or alkaline earth metal. In absence of sufficient quantity of such a metal, there is a tendency for a reddish coloration to be produced.

The substances necessary to produce the blue colour are therefore oxygen and boletol, laccase and manganese, and an alkali or alkaline earth metal. N. H. J. M.

**Reserve Carbohydrates of the Seed of *Aucuba Japonica*, L.** By G. CHAMPENOIS (*Compt. rend.*, 1901, 133, 885—887).—The seed of *Aucuba Japonica*, L., contains both soluble and insoluble carbohydrates. The soluble portion extracted by boiling alcohol was found to contain sucrose and a glucoside. The insoluble residue contains a galactan, mannan, and pentan, giving, on hydrolysis, galactose, mannose, and a pentose respectively. The pentose appears to be arabinose.

G. T. M.

**Supposed Presence of Solanin in Tobacco Seeds.** By JOHANNES STARKE (*Bull. Acad. Roy. Belg.*, 1901, 7, 379—383. Compare Abstr., 1900, ii, 234).—The seeds of *Nicotiana macrophylla* and *Tubac de Gramont* do not contain solanin. H. R. LE S.

**Dried Brewers' Grains.** By TH. DIETRICH (*Landw. Versuchs-Stat.*, 1901, 56, 207—256).—A detailed account of the processes involved in the production of brewers' grains, with the results of analyses by various investigators. N. H. J. M.

**Dried Distillery Grains.** By TH. DIETRICH (*Landw. Versuchs-Stat.*, 1901, 56, 257—262).—The grains are obtained in the so-called aëration-process in the preparation of yeast. The only published analyses seem to be those given by Wolff (Menzel and von Lengerke's *Landw. Kalender*, 1890).

The results of analyses now given show that the crude proteid contains 95 per cent. of pure proteids. The digestibility resembles that of brewers' grains. The amount of fat varies a good deal and increases with the amount of maize employed.



The dried grains resemble brewers' grains as regards their use in cattle feeding, but they generally have a higher value than the latter.  
N. H. J. M.

**Influence of Nutritive Salts on the Production of Nodules on [the Roots of] Peas.** By EM. MARCHAL (*Compt. rend.*, 1901, 133, 1032—1033).—Water-culture experiments, in which peas, inoculated from young nodules, were grown in dilute solutions of various salts. It was found that alkali nitrates in 0.01 per cent. solutions, ammonium salts in 0.05 per cent., potassium salts in 0.5 per cent., and sodium salts in 0.3 per cent. solutions prevented the formation of nodules. Calcium and magnesium salts, on the other hand, are favourable, and phosphoric acid, although its action varies according to the base, seems also to have a stimulating effect.  
N. H. J. M.

**[Effect of Manures on] the Development of Leguminous Root Nodules.** By ÉMILE LAURENT (*Compt. rend.*, 1901, 133, 1241—1243).—In the case of peas, it was found that ammonium sulphate reduced the number of nodules the first year, whilst potassium salts and superphosphate both promoted their formation. Calcium carbonate reduced the number, but increased the size of the nodules. With sodium chloride, the nodules were small and the number was diminished. In subsequent years, the effects of the manures became more pronounced, the nodules disappearing altogether in the plots which received sodium nitrate and ammonium sulphate, and becoming more and more numerous on the plots which had potassium salts and superphosphate. The soil, however, in which the peas (under the influence of nitrogenous manures) grew without nodules, was found to contain the microbes and was successfully employed for inoculation.

The results obtained with peas do not hold good for all leguminous plants. In the case of beans, for instance, nitrogenous manures were found to promote the formation of nodules. Hairy vetches manured with sodium chloride had many nodules.  
N. H. J. M.

**Cultivation of Clover on Soils without Calcium Carbonate.** By PIERRE P. DEHÉRAIN and E. DEMOUSSY (*Compt. rend.*, 1901, 133, 1174—1177).—Clover was grown in heath soil manured with potassium phosphate, and in the same soil with (1) 20 per cent. of calcium carbonate, (2) 10 per cent. of garden soil, and (3) both calcium carbonate and garden soil in the same quantities as before. The original soil contained about 1 per cent. of calcium as sulphate.

The results showed that the original soil contains the nodule bacteria and that the yield of clover was greatly increased by the addition of garden soil. Calcium carbonate had very little effect when applied alone, and diminished the yield when added along with garden soil, as compared with the yield obtained under the influence of garden soil alone.

Further experiments with a soil from Brittany, which contained no calcium at all, showed that it was greatly benefited (for clover) by adding 10 per cent. of calcium carbonate, whilst garden soil had much less effect.  
N. H. J. M.

**Nutrition and Physiological Studies on Hops.** By THEODOR REMY and O. ENGLISCH (*Bied. Centr.*, 1901, 30, 808—810; from *Bl. Gersten-, Hopfen-, u. Kartoffelbau.*, 1900, 457).—The maximum growth of hops was found to be during the period of flower and fruit production. In the spring, the perennial portions of the plants contain 30—40 per cent. of the total nitrogen, potassium, and phosphoric acid required. Assimilation from the soil is at first slow, but afterwards increases, and reaches a maximum when the fruit develops; when the hops are ripe, assimilation ceases. The taking up of calcium and magnesium follows on the whole that of the constituents already mentioned, but the supply of these constituents in the root is less than that of nitrogen, potassium, and phosphoric acid, and their assimilation seems to continue after the ripening period.

As regards the total amounts of minerals, the hop plant requires very considerable amounts of calcium and magnesium, more even than red clover. Large amounts of potassium are also required.

Nitrogen, potassium, and phosphoric acid migrate from the stems and leaves, before their death, to the fruit; but there is simultaneously a gain of calcium and magnesium in the leaves. The roots also acquire more nitrogen, potassium, and phosphoric acid.

N. H. J. M.

**Partial Milking.** By EDWIN ACKERMANN (*Chem. Zeit.*, 1901, 25, 1160—1162).—A paper containing several tables and illustrated with curves showing the increase of fat as the milking proceeds.

The idea that in the ordinary process of milking the fat keeps on regularly increasing is not correct, except in the case of goats. Every teat yields a milk which shows a constantly increasing percentage of fat. If, as is customary, two teats are emptied first, the same phenomenon will again present itself when emptying the other pair, as the milk will be again poor in fat at first. The minimum, and also the maximum, amount of fat slightly increases for the milk removed by each succeeding teat.

L. DE K.

**Production of Milk and Butter: Effect of Feeding on the amount of Fat in Milk.** By L. MALPEAUX and E. DOREZ (*Ann. Agron.*, 1901, 27, 561—593).—Of the various rations employed with nutritive ratios of 1:8 to 1:3, the best results were obtained when the ratio was 1:6. More concentrated foods increase the live weight at the expense of milk and butter production.

The comparison of the different cakes used for feeding showed that cotton cake was the best, then followed cocoa-nut, linseed, sesamé, colza, and poppy-seed cakes. Mangel leaves, maize fodder, and mustard are unsuitable for butter production, and should only be used in limited quantities. Potatoes are not recommended; carrots are better than mangels, but not in proportion to their cost. Oats increase butter production, and wheat bran promotes milk secretion but should not be used so as to exclude cake.

N. H. J. M.

**Utilisation of Gluten Proteid by Ruminants.** By OSCAR KELLNER (*Landw. Versuchs-Stat.*, 1901, 56, 149—152).—It was found

that extracting gluten meal prepared from wheat with ether for 16 hours did not remove the whole of the fat, and that a further considerable amount of fat could be extracted after digestion with pepsin and hydrochloric acid. This involves a correction in the results as previously given (*Landw. Versuchs-Stat.*, 1894, 44, 390), but does not affect any of the conclusions drawn from them. N. H. J. M.

**Causes of Sterility in Peat Soils.** By J. DUMONT (*Compt. rend.*, 1901, 133, 1243—1246).—Whilst the nitrogen present in a sample of peaty soil nitrified extremely slowly, it was found that ammonium sulphate added to the same soil was quickly nitrified, indicating that the soil is favourable to nitrification, but not to the production of ammonia from organic nitrogen. Further experiments showed that the different samples of peaty soil examined contained very little potassium, and that the addition of potassium carbonate to one of them gave rise to the production of ammonia. The best results were obtained by adding 2 per cent. of potassium carbonate, but 1 per cent. had a very considerable effect. The conclusion is drawn that potassium carbonate ought to be applied to peat land. N. H. J. M.

**Green Manuring on Heavy Soil.** By F. HANUSCH (*Bied. Centr.*, 1902, 31, 11—12; from *Zeit. Landw. Versuchswe. Oesterr.*, 1901, 772).—Plot experiments of 5—8 ares are described in which the produce of various crops, and also their nitrogen and ash content, both in the portions above ground and in the roots, were determined. The amounts of nitrogen and of organic matter per hectare were as follows: field peas, 18.6 and 378.1; horse beans, 41.4 and 887.1; vetches, 75.5 and 1543.6; and white mustard, 90 and 3067.4 kilos. The most remunerative crop was therefore white mustard, and this was followed by vetches, horse beans, and field peas in the order given. The crops have been used as manure for a cereal. N. H. J. M.

**Relative Value of different Phosphates.** By DIMITRY PRIANISCHNIKOFF (*Landw. Versuchs-Stat.*, 1901, 56, 107—140).—The results of sand culture experiments showed that the availability of sparingly soluble phosphates varies with different crops. It will be possible when more data are obtained to exactly express the coefficient of availability in the case of different plants. The following numbers indicate provisionally the relative amounts of phosphoric acid assimilated in sand culture experiments:

	Phosphorite.	Bone meal.	Basic slag.	CaHPO <sub>4</sub> .
Cereals.....	0—10	40	60—70	100
Buckwheat, lupins, &c. ...	60	90	100	100

Phosphorite should not be applied to black soil or to light soils (probably not to any soils long cultivated) for cereals, but only for buckwheat, mustard, lupins, and peas. In the case of peat land, however, and acid soils generally, phosphorite may be applied for any crop. An experiment on black soil is recorded in which, without manure, buckwheat gave much more produce than wheat: the addition of phosphorite and of sodium dihydrogen phosphate greatly increased the yield of

wheat, but not the yield of buckwheat. This is attributed to the greater assimilative power of buckwheat for sparingly soluble phosphoric acid.

Experiments are described in which phosphates were applied in conjunction with varying amounts of ammonium sulphate, and of sodium, calcium and ammonium nitrates. It was found that ammonium salts act as a strong solvent for phosphorite. N. H. J. M.

**Action of Kainite and of High Per Cent. Potassium Salts.** By MAX GERLACH (*Bied. Centr.*, 1901, 30, 794—795; from *Fühling's landw. Zeit.*, 1901, 11 and 12).—Experiments with barley in soil poor in potassium showed that kainite produced far better results than high per cent. "potassium salts" containing the same amount of potassium. This is attributed to the fact that the kainite contained twice as much sodium chloride as the "potassium salts"; and the conclusion is drawn, in agreement with Wagner, that sodium can economise potassium partly by liberating potassium from the soil and partly by satisfying the mineral requirements of the crop.

In the case of potatoes, "potassium salts" have the advantage, as compared with kainite, that they contain less chlorides; but even "potassium salts" reduce the percentage of starch. N. H. J. M.

**Manurial Value of the Excretions of Cows.** By W. S. SWEESTER (*Bied. Centr.*, 1901, 30, 793—794; from *Pennsylvania State Coll. Agric. Exper. Stat. Bull.*, 54, 1900).—The results of analyses of the milk, faeces, and urine of two cows fed, during 5 periods, with known amounts of different foods, showed that the milk contained about one-sixth of the total nitrogen, one-quarter of the phosphoric acid, and a tenth of the potash contained in the whole of the excretion. N. H. J. M.

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## Analytical Chemistry.

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**New Drying Oven.** By HERMANN THOMS (*Ber.*, 1901, 34, 4254—4255).—The chief novelty in the drying oven described is that it has holders for the stems of funnels instead of the usual holes in a shelf. R. H. P.

**Estimation of Fluorine in Fluorides easily Decomposable by Sulphuric Acid.** By W. E. BURK (*J. Amer. Chem. Soc.*, 1901, 23, 825—829).—A modification of Carnot's process (*Abstr.*, 1892, ii, 911). The apparatus consists of a 150 c.c. Erlenmeyer flask closed with a trebly perforated rubber stopper. The first hole admits a rectangularly bent tube reaching to nearly the bottom of the flask, the other end being connected with two straight drying tubes containing respectively dry calcium chloride and glass wool moistened with sulphuric acid. The second and third holes are closed with a



stopcock funnel and a bent glass tube, one end of the latter terminating just below the rubber stopper, whilst the other end projects into a U-tube plugged below the corks with glass wool. This tube is in turn connected with two U-loops bent from 5 mm. glass tubing connected with tight rubber joints and plugged with glass wool, the plugs being designed to interrupt the air current and stop any sulphuric acid fumes not previously eliminated; these loops are immersed in beakers containing cold water. The products of the reaction are passed to the bottom of a glass cylinder containing some mercury; the cylinder is closed by means of a treble perforated rubber stopper, through the second hole of which passes a stopcock funnel, whilst the third admits an exit tube connected with an aspirator. Before use, the whole apparatus is heated with a naked flame while a slow current of air is passed in order to secure complete dryness. When the current is stopped, 20 c.c. of a 10 per cent. solution of potassium fluoride are introduced by means of the funnel into the cylinder and the stopper of the Erlenmeyer flask having been momentarily removed, a mixture of 0.20 gram of the dried fluoride with 3 grams of pure, recently ignited silica are introduced. Forty c.c. of sulphuric acid previously aerated by a current of dry air while heated at  $165^{\circ}$  are introduced into the funnel, and the acid is now admitted into the flask and heated in an oil-bath for an hour and a half at  $120^{\circ}$ , a slow current of air being passed all the time. The liquid above the mercury, which has absorbed the silicon fluoride, is now transferred to a beaker and mixed with an equal volume of 90 per cent. alcohol. The precipitate, consisting of potassium silicofluoride, is collected on a Gooch crucible using reduced pressure, washed with alcohol, dried at  $100^{\circ}$ , and weighed. The weight multiplied by 0.34511 gives the fluorine, and this multiplied by 2.0527 equals calcium fluoride.

L. DE K.

**Colorimetric Method for Estimating Oxygen dissolved in Water.** By WILLIAM RAMSAY and IDA HOMFRAY (*J. Soc. Chem. Ind.*, 1901, 20, 1071—1074).—The process is based on the fact that an ammoniacal solution of cuprous chloride turns blue in the presence of oxygen, the intensity of the colour depending on the quantity of oxygen present. The effluent to be tested is introduced by means of a special arrangement into a modified Mill's colorimeter, contact with the air being excluded by means of a layer of paraffin oil; the comparison tube contains water saturated with air (oxygen) at a known temperature. Into both tubes are introduced the same quantity of cuprous chloride, dissolved in hydrochloric acid immediately before use, and then an excess of ammonia. After a while, the two colours are compared and the usual calculation is applied. If the effluent contains much lime, it is advisable to add to the contents of both tubes 2 or 3 c.c. of a hot saturated solution of ammonium chloride in order to prevent turbidity on adding ammonia. If the effluent is yellowish, the water used for comparison may be slightly tinged with an alkaline solution of *p*-nitrophenol. For a minute description of the process, and also for that of a portable apparatus devised by the authors, the original paper should be consulted.

L. DE K.

**Photometric Estimation of Sulphates.** By D. D. JACKSON (*J. Amer. Chem. Soc.*, 1901, 23, 799—806).—The apparatus consists of a 100 c.c. Nessler jar, 2.5 cm. in diameter and 17 cm. to the 100 c.c. mark, and graduated from the bottom in centimetres and millimetres. A standard candle is used, above which is suspended an iron ring with an indicator so that the top of the ring is always three inches above the top of the candle. The observations are made in a dark room, and the candle is placed over a dark surface. The tube intended for the solution is enveloped in a brass holder which comes up almost to the 100 c.c. mark and has a broad disc at the bottom which shields the eye from the strong light below. The bottom of this cylindrical tube is entirely open except for a very narrow rim which serves to keep the glass tube in place. The inside of the holder is painted a dull black to prevent reflection. The solution to be tested is washed into the jar and slightly acidified with hydrochloric acid. After diluting with water nearly to the mark, 2 grams of solid barium chloride are added, and the whole is diluted to exactly 100 c.c.; the tube is then closed with a pure rubber stopper, and thoroughly shaken until the barium chloride is dissolved. The tube is now placed in the brass holder and the contents are poured backwards and forwards from the tube into a lipped beaker, keeping the precipitate constantly shaken up so as to have a uniform turbidity. When the holder is placed on the iron ring suspended 3 inches above the top of the candle and the eye held quite near the top of the glass tube, a point is finally reached when the flame of the candle just disappears. The height at which the solution stands in the tube (reading at the bottom of the meniscus) is then taken, and from this reading the percentage of sulphuric anhydride may be calculated from the formula  $x = 0.0574/y + 0.1$ , in which  $x$  equals the sulphuric anhydride and  $y$  the depth in centimetres of the liquid in the cylinder. Tables are given to save calculation.

To apply the process to waters, 100 c.c. of the sample (concentrated if necessary) are used. Water poor in sulphates may also be tested by comparing the turbidity produced by barium chloride with silica standards such as are in use for the determination of the turbidity of drinking water; a standard of 10 in silica is equivalent to 1.45 parts per million of sulphuric anhydride. Of urines, it is sufficient to take 10 c.c.; for coal and cement, 1 gram will suffice.

The results are sufficiently accurate for technical purposes, as in most cases it is only a question of the presence of an undue excess of sulphur or sulphates.

L. DE K.

**Estimation of Nitrogen.** By FERDINAND JEAN (*Ann. Chim. anal.*, 1901, 6, 441).—When using conical cast iron flasks of 1 litre capacity as distillation flasks in the Kjeldahl process, it was found that a portion of the liquid was violently carried over into the worm of the condenser, and so passed into the acid in the receiver. To remedy this defect, the flasks are now fitted with a bulb of 500 c.c. capacity. The tube connected with the bottom of the bulb has a diameter of 15 mm., and passes through a cork into the distilling flask; the tube at the top

has a diameter of 18 mm., is bent laterally, and connected with the condenser. During the distillation, the liquid may fill about one-third of the bulb; to prevent too strong a condensation, the bulb and the top part of the flask are wrapped round with paper.

The use of sodium hypophosphite instead of sulphide is recommended to decompose ammoniacal mercury compounds during the distillation.

L. DE K.

**Colorimetric Estimation of Nitric Acid in Water.** By HERM. NOLL (*Zeit. angew. Chem.*, 1901, 14, 1317—1319).—Twenty c.c. of sulphuric acid containing 0.05 gram of brucine are added to 10 c.c. of the sample of water; should this contain more than 0.05 gram of nitric acid per litre, it must be first suitably diluted. After a quarter of a minute's action, the liquid is poured into a Hehner's cylinder containing 70 c.c. of water. For comparison, a solution containing 0.1871 gram of potassium nitrite per litre is used, which is treated in the same manner, and of the darker-coloured liquid a portion is then withdrawn until the colours are equalised. Nitrites, if present, should be allowed for.

L. DE K.

**Estimation of Nitrates in Chlorinated Waters.** By RENÉ MARCILLE (*Ann. Agron.*, 1901, 27, 596—600. Compare Abstr., 1885, 1093).—The picrate method gives incorrect results in presence of chlorides. The following modification was found to be very satisfactory. After determining the amount of chloride present, a slight excess of a 20 per cent. ammoniacal solution of silver sulphate is added to 10 c.c. of the water in a 25 c.c. porcelain basin. As a rule, only a fraction of a cubic centimetre of silver sulphate is required, and a pipette is employed which gives an ascertained number of drops for each c.c. The water is then evaporated on a sand-bath heated not much above 120°. The cold residue is treated with 1.5 to 2 c.c. of a solution of phenol (8.1) in sulphuric acid (100 parts), every particle of silver chloride being detached from the dish and well crushed. About 10 c.c. of water and a slight excess of ammonia are then added, and the whole poured into a 50 or 100 c.c. flask, which is filled with water. Filtration is unnecessary, as any undissolved silver chloride quickly settles. The comparison of the coloration is made in the usual manner.

N. H. J. M.

**Gasometric Estimation of Nitrites in Urine.** By PAUL GERLINGER (*Zeit. angew. Chem.*, 1901, 14, 1250—1252).—Gailhat's process (Abstr., 1900, ii, 686) may be applied to the estimation of nitrites in urine. The method employed by the author is briefly as follows: the urine is boiled in an Erlenmeyer flask with solution of ammonium chloride, the steam being condensed and returned by a vertical condenser, and the liberated nitrogen collected over aqueous potassium hydroxide contained in an azotometer. Before adding the urine to the heated solution of ammonium chloride by means of a dropping funnel, the air of the apparatus must be completely displaced by a current of carbon dioxide, and this gas is again passed after the reaction is complete to sweep out every trace of nitrogen. The results of several experiments are communicated to show the accuracy of the method.

L. DE K.

**Estimation of Phosphoric Acid in Phosphates.** By JOSEPH A. MULLER (*Bull. Soc. Chim.*, 1901, [iii], 25, 1000—1002).—For the standardisation of uranium solutions for the volumetric determination of phosphoric acid in phosphates, the author recommends the use of the crystallised salt,  $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$ , in nitric acid solution, this salt having the advantage over sodium phosphate and hydrogen sodium ammonium phosphate that it loses its water of crystallisation with much greater difficulty, and therefore allows of greater accuracy in the preparation of the solutions. Attention is also called to certain precautions to be observed in the analysis of this salt. A. F.

**Preparation of Volumetric Solution of Sodium Arsenite.** By GEORG LUNGE (*Zeit. angew. Chem.*, 1901, 14, 1293).—A reply to Petriccioli and Reuter (*ibid.*, 1181), who object to Lunge's method of preparing sodium arsenite by boiling arsenious acid with solution of sodium hydrogen carbonate, as sodium carbonate will be formed and this consumes iodine.

The authors' experiments show that a solution of sodium carbonate absorbs but minimal quantities of iodine; moreover, a solution of sodium hydrogen carbonate, after half an hour's boiling, contains no sodium carbonate, but an intermediate carbonate which scarcely acts on iodine, particularly in presence of potassium iodide. L. DE K.

**Estimation of Carbon in Steel by Direct Combustion.** By BERTRAM BLOUNT (*Analyst*, 1902, 27, 1—5).—Five grams of steel drillings or turnings are mixed with 15 to 20 grams of recently fused lead chromate and placed in a large porcelain boat, which in turn is placed in a long, deep tray of sheet platinum and the whole slid into a porcelain combustion tube. The front part of this tube containing copper oxide is heated in a Fletcher combustion furnace, and the back part also is similarly heated, but the precise spot where the boat lies is heated for one hour by means of a benzoline blast lamp. The combustion takes place in a current of purified oxygen and the products of combustion are passed through specially constructed drying and absorption apparatus. The paper is fully illustrated. L. DE K.

**Estimation of Silicon in Steel.** By GEORGE AUCHY (*J. Amer. Chem. Soc.*, 1901, 23, 817—820).—Drown's method (evaporation with nitric and sulphuric acids) gives good results with samples of pig iron, but with steels the results are much too low. This, according to Dudley, is caused by the iron sulphate enclosing and protecting the silicic acid from the dehydrating action of the sulphuric acid and may be remedied by vigorous stirring; this has been confirmed by the author, but the process then becomes too tedious for use in steel works. Dudley also suggested that if the iron salts could only be kept in solution until the silica is rendered quite insoluble, it would greatly improve matters. The author found that if nitrohydrochloric acid is used instead of nitric acid, the sulphate does not separate so readily, but the loss of silica is not prevented thereby.

The old Swedish process (evaporation with sulphuric acid only) gives very satisfactory results and may be generally recommended. Both this and Drown's process give, with high silicon pig, results



which are from 0.1—0.15 per cent. too low; this loss is not due to the protecting action of iron sulphate, but to the same causes which leave a considerable amount of silica in solution in an ordinary silicate analysis after one evaporation. L. DE K.

**Analysis of Silicates.** By LEHMANN and STROHÉ (*Chem. Zeit.*, 1901, 25, 1031—1032).—To obtain a correct estimation of iron, the permanganate process should be used, after reducing the sulphuric acid solution of the ferric and aluminium oxides with zinc twisted round with platinum wire.

The following process is given by Strohé for the estimation of potassium in clays if sodium is supposed to be absent. Five grams of the sample are heated with 6 c.c. of sulphuric and 30 c.c. of hydrofluoric acid. The dry residue is dissolved in boiling water with addition of a little hydrochloric acid, and when cold diluted to 500 c.c. One hundred c.c. of the solution are first precipitated with ammonia; in the filtrate, the calcium is precipitated with ammonium oxalate, and the solution is then evaporated to dryness. After heating to expel ammonium compounds, the residue is converted into a mixture of magnesium and potassium sulphates by evaporating with sulphuric acid, and the sulphates are gently ignited and weighed. The magnesium sulphate is then estimated in the usual manner and the potassium sulphate found by difference. L. DE K.

**Estimation of Potassium by Picric Acid.** By C. REICHARD (*Chem. Zeit.*, 1901, 25, 1151—1154. Compare *Abstr.*, 1901, ii, 577).—The author has successfully estimated potassium in potassium nitrate as follows: about 0.25 gram of the nitrate is put into a weighed, glazed, spherical, porcelain dish and dissolved in just sufficient cold water; 0.7 gram of sodium picrate is also dissolved in the smallest possible quantity of cold water, both solutions are heated to boiling, and the picrate is poured into the dish. After a few hours, when the potassium picrate has almost completely crystallised, the liquid is, if necessary, poured on to a small filter, and the crop of crystals carefully washed, without being broken up, with a few c.c. of water at a time. The basin is then dried at 80° until the weight is constant. Any particles of the salt which have got on to the filter may easily be brushed off from the dry paper. The salt is soluble in water to the extent of 1 in 200, but as it contains only one-seventh part of its weight of potassium the error caused by the solubility is small. L. DE K.

**Estimation of Alkalis in Portland Cement and Natural Cements.** By THOS. B. STILLMAN (*Chem. Centr.*, 1901, ii, 1369; from *Steven's Institute Indicator*).—The filtrate from the calcium precipitate is evaporated with sulphuric acid, the residue ignited until constant in weight, and the magnesium then estimated as usual, and calculated into sulphate. The alkali sulphate is found by difference. L. DE K.

**Estimation of Cæsium and Rubidium as Hydrogen Sulphates, and of Potassium and Sodium as Pyrosulphates.** By PHILIP E. BROWNING (*Zeit. anorg. Chem.*, 1901, 29, 140—144).—Salts of cæsium and rubidium with volatile acids, when treated with

sulphuric acid and heated at between  $250^{\circ}$  and  $270^{\circ}$  until constant in weight give the acid salts  $\text{CsHSO}_4$  and  $\text{RbHSO}_4$ . On igniting over a free flame, the normal sulphates,  $\text{Cs}_2\text{SO}_4$  and  $\text{Rb}_2\text{SO}_4$ , are produced. Cæsium hydrogen sulphate shows a slight tendency to retain a little sulphuric acid.

Potassium and sodium salts, when treated with sulphuric acid and heated at  $250$ – $270^{\circ}$ , give the pyrosulphates  $\text{K}_2\text{S}_2\text{O}_7$  and  $\text{Na}_2\text{S}_2\text{O}_7$ . Under similar conditions, lithium gives neither a hydrogen sulphate nor a pyrosulphate.

J. McC.

**Standardisation of Potassium Permanganate with Iron.** By HERMANN THIELE and HANS DECKERT (*Zeit. angew. Chem.*, 1901, 14, 1233–1234).—The authors have made a series of experiments from which it appears that for the standardising of permanganate it is better to use pure oxalic acid than the various kinds of so-called pure iron recommended for that purpose.

L. DE K.

**Simple Method for the Estimation of Iron in Metabolism Experiments.** By ALBERT NEUMANN (*Chem. Centr.*, 1901, ii, 1369–1370; from *Arch. Anat. Phys.* [His-Engelmann], *Physiol. Abt.*, 1901, 541–543).—The material is completely oxidised with a mixture of sulphuric and nitric acids. The solution is rendered alkaline with ammonia, and then slightly acidified with dilute sulphuric acid. A slight excess of zinc oxide is added, the precipitate is washed by decantation, then suspended in 30 c.c. of water, and dissolved in the smallest possible quantity of hydrochloric acid; ammonia is added until a precipitate of zinc hydroxide begins to form, which is then redissolved in a little hydrochloric acid. To the liquid are now added 1–2 grams of potassium iodide and a little zinc iodide starch solution, and the iodine liberated by the ferric oxide is titrated with  $N/100$  sodium thiosulphate.

L. DE K.

**Estimation of Tungsten in Tungsten Steel.** By RUDOLF FIEBER (*Chem. Zeit.*, 1901, 25, 1083).—A modification of Fresenius's method. Five grams of steel borings are dissolved in hydrochloric acid. After boiling, the insoluble matter is collected and fused with potassium sodium carbonate, the fused mass dissolved in water, and the solution added to the main filtrate; the whole is then evaporated to dryness in a porcelain dish, and the residue heated to  $120^{\circ}$ . The mass is then dissolved in hydrochloric acid and boiled in a beaker for 3 hours, when some water is added to prevent destruction of the filter paper. The precipitated tungstic acid carries down the silicic acid and also traces of iron and chromium, and the filtrate is again boiled for 3 hours to recover the last traces of tungstic acid. The washed precipitate is ignited, fused with potassium sodium carbonate, and the fused mass dissolved in water. The filtrate is neutralised with nitric acid, boiled to expel carbon dioxide, and after ascertaining that the liquid is really neutral (easily recognisable by the yellowish-green colour of the solution), the tungstic acid is precipitated by means of mercurous nitrate; the mercurous tungstate on ignition yields tungstic acid, which can be freed from any silicic acid by evaporating with hydrofluoric acid.

L. DE K.

**Estimation of Tin by Lenssen's Method.** By JOSEPH A. MULLER (*Bull. Soc. Chim.*, 1901, [iii], 25, 1002—1004).—The author has tested the method of estimating tin volumetrically by means of iodine, and finds that, in general, even when all precautions are taken to avoid the oxidation of the stannous solutions, the figures obtained are too low. The specimen of tin employed was found by gravimetric analysis to contain 99·76 per cent. of tin, and the numbers obtained by the volumetric method varied from 98·68 to 99·35 per cent. On using pure tin, the numbers obtained were 99·31 and 99·24 per cent.

A. F.

**Analysis of Tin Ores.** By JOSEPH A. MULLER (*Bull. Soc. Chim.*, 1901, [iii], 25, 1004—1007).—For the determination of tin in tinstone, the author points out that if tin dioxide is the only reducible substance present, the loss of weight on reduction in a current of hydrogen enables the amount of tin contained in the ore to be calculated directly. It is also shown that when the ore is exposed to a medium red heat in a current of hydrogen, complete reduction is effected in 3 hours. When other reducible substances (zinc blende, galena, tungsten, &c.) are present in the ore, these must first be got rid of by treatment with various reagents.

The above method was also applied to the estimation of tin in its sulphur ores, the stannic sulphide being first converted into dioxide by calcination and treatment with nitric acid. Thus, in one case, the amount of tin found by this method was 26·77 per cent., whereas a complete analysis showed the presence of 24·94 per cent. A. F.

**Volumetric Estimation of Antimony in Hydrochloric Acid Solution with Permanganate and its Practical Application.** By O. PETRICCIOLI and MAX REUTER (*Zeit. angew. Chem.*, 1901, 14, 1179—1183).—0·5 to 5 grams of the finely powdered ore are put into a beaker and 50 c.c. of hot water and 50 c.c. of hydrochloric acid are added. After heating at 70° on a sand-bath for half an hour or an hour, the antimony will be dissolved. The solution is filtered, and the insoluble matter washed first with acidified water, then with plain water. After adding some tartaric acid, the solution is diluted to about 750 c.c., heated to 60—70°, and precipitated with hydrogen sulphide; the precipitate is washed, then rinsed back into the beaker with hot water and heated with 50 c.c. of hydrochloric acid until no more hydrogen sulphide is evolved. Water is added until a slight turbidity is formed which is then removed by adding a few drops of acid. The solution may now be at once titrated with potassium permanganate, 2 mols. of which correspond with 5 atoms of antimony. Ores or products containing the higher oxide of antimony cannot be tested in this manner, but they may be rendered soluble by fusion with sodium carbonate and sulphur. The fused mass is dissolved in water and precipitated with acetic acid; the precipitate consisting of antimony sulphide with much free sulphur is treated with potassium chlorate and hydrochloric acid, filtered, the solution again precipitated with hydrogen sulphide and treated as previously directed.

L. DE K.

**Estimation of Organic Matters in Drinking Water.** By GUSTAVE DE RIDDER (*Rev. intern. Falsific.*, 1901, 14, 149).—The author recommends the Schulze-Frommsdorff process, as this is not interfered with by the presence of chlorides. This process consists in boiling the water with  $N/100$  alkaline permanganate for 10 minutes; when cooled to  $60^{\circ}$ , the liquid is acidified with dilute sulphuric acid,  $N/100$  oxalic acid equal to the permanganate employed is added, and the excess of oxalic acid is then again titrated with permanganate. L. DE K.

**Estimation of Fused Oil in Alcoholic Liquids.** By ERNST BECKMANN (*Zeit. Nahr.-Genussm.*, 1901, 4, 1059—1064).—The author has modified his process (*Abstr.*, 1900, ii, 175) as this did not always work satisfactorily.

To remove the fusel oil from the alcoholic liquid, 20 grams of dry calcium chloride are dissolved in 50 c.c. of the sample (brandy), and water is added to reduce the alcoholic strength to 50 per cent.; the mixture is now shaken for 10 minutes with 30 c.c. of carbon tetrachloride, and for this purpose Recklinghausen's shaking machine is recommended (*Abstr.*, 1897, ii, 19). After transferring the carbon tetrachloride to another separating funnel containing 20—25 c.c. of water, the liquid is again shaken for 10 minutes with 20 c.c. of carbon tetrachloride and then twice in succession with 20 c.c. for 15 minutes each time; all the extracts are mixed and shaken for 5 minutes with water which removes ethyl alcohol, but as it may also remove some of the higher alcohols, these must be recovered by adding 10 grams of calcium chloride and shaking for 5 minutes with 80 c.c. of carbon tetrachloride.

To convert the amyl alcohol into amyl nitrite, the dried solution may be treated with nitrous acid evolved from arsenious acid and nitric acid, but the following modification is more convenient in practice.

The solution containing the fusel oil is dried by means of a little calcium chloride and filtered through glass wool. Three grams of powdered sodium hydrogen sulphate and 3 grams of sodium nitrite are added, and after half an hour's action the liquid is again filtered and freed from excess of acid by shaking with 3 grams of powdered sodium hydrogen carbonate; water is now added to dissolve the soda, which is then removed from the funnel. To estimate the amount of amyl nitrite, the solution is shaken with 10 c.c. of sulphuric acid; this completely decomposes the amyl nitrite with formation of nitroso-sulphuric acid. The whole is now added to 100 c.c. of water, cooled with pieces of ice, and the nitrous acid titrated with solution of potassium permanganate (1:1000). If aldehydes are present, these may be removed by shaking the carbon tetrachloride extract with powdered sodium hydrogen sulphite, dissolving the latter in a little water and removing it from the funnel. L. DE K.

**Use of Sodium Salicylate in the Estimation of Mixtures of Terpene-alcohols and their Ethers.** By GEORGES DARZENS and P. ARMINGEAT (*Bull. Soc. Chim.*, 1901, [iii], 25, 1053—1055).—Charabot and Hébert have brought forward a method for the separ-



ation of terpene-alcohols from their esters, based on the solubility of the alcohols in a 50 per cent. solution of sodium salicylate. It is pointed out that the terpene esters are capable of dissolving in 50 per cent. sodium salicylate when the latter already contains terpene-alcohols, and this may form a serious source of error in the separation of the alcohols and esters by this method.

T. M. L.

**The Copper Test for Sugar [in Urine].** By ALBERT B. LYONS (*Pharm. Rev.*, 1901, 19, 531—533).—In doubtful cases, the author operates as follows :—Two or three drops of Fehling's solution are diluted with 30 minims of water, heated to boiling, and mixed with 5 drops of the urine. After boiling for 1 minute, the contents are examined ; if there should be no precipitate of cuprous oxide, this does not prove that there has not been any reduction ; the liquid is therefore slightly acidified with hydrochloric acid and mixed with a few drops of a 5 per cent. solution of potassium iodide. If this should yield an abundant precipitate of cuprous iodide, sugar is present in some quantity. The experiment is now repeated, using only 1 drop of urine, and if the potassium iodide still produces a distinct cloudiness, there must be at least 1 grain of sugar per ounce of urine ; urines containing more sugar must be suitably diluted.

The author confirms the amount of sugar by the picric acid test. Two c.c. of the sample are mixed with 1 c.c. of a saturated solution of picric acid and 1 c.c. of aqueous potash U.S.P., and boiled for 1 minute. The dark-coloured liquid is now diluted until it corresponds in colour with a solution made by dissolving 5 grams of potassium dichromate in a mixture of 50 c.c. of water and 25 c.c. of 10 per cent. sulphuric acid, and subsequently diluting to 100 c.c. Twenty c.c. are then deducted from the final volume, and each c.c. in excess corresponds with 1/300 per cent. of diabetic sugar.

L. DE K.

**Gravimetric Estimation of Sugar.** By O. LAUENSTEIN (*Zeit. Nahr.-Genussm.*, 1901, 4, 1026—1027).—On account of the difficulty experienced in removing the last traces of cuprous oxide from the basin, the author now removes these by means of a wet piece of ash-free filter-paper of the size of a shilling, which is manipulated with a glass rod. After removing with the wash-bottle as much of the precipitate as possible, the paper is also brought into an asbestos tube, and the whole burnt in a current of air previous to being reduced in hydrogen.

L. DE K.

**Testing of Honey.** By ALBERT HILGER (*Zeit. Nahr.-Genussm.*, 1901, 4, 1142—1143).—A preliminary communication on the composition of 24 German honeys (including 9 forest honeys), 22 foreign honeys, of which 2 are from Greece, 13 from America, 1 from Spain, 1 from Roumania, 3 from Hungary, 1 from Norway, and 1 from Slavonia : also of 8 artificial products. The analyses were restricted to the sp. gr. of the solution 1 : 2, water, sugar before and after inversion, cane sugar, non-saccharine substances, ash, polarisation, and free acid calculated as formic acid. The behaviour of the dextrins towards yeast was also investigated. Full particulars will shortly be communicated.

L. DE K.

**Honey Dextrin.** By ERNST BECKMANN (*Zeit. Nahr.-Genussm.*, 1901, 4, 1065—1069).—Honey-dextrin, to which some pure honeys owe their right-handed polarisation, is distinguished from other dextrans by giving but a slight precipitate with barium hydroxide in the presence of methyl alcohol. The other dextrans show, however, also enormous differences in their behaviour towards barium hydroxide or basic lead acetate in the presence of methyl alcohol. It was found that those specimens which darken most with iodine yield the most abundant precipitate. The precipitation in both cases is lessened in the presence of much sugar (dextrose).

According to Monheim the benzoyl ester of honey-dextrin is most likely a mixture of a penta- and hexa-benzoate of a disaccharoid, distinguished from the ordinary dextrin compound by its solubility in ether.

L. DE K.

**Estimation of Glycogen and Starch in Sausages and Meat.** By JOSEPH MAYRHOFER (*Zeit. Nahr.-Genussm.*, 1901, 4, 1101—1106).—Glycogen and starch may be readily separated by means of 49 per cent. alcohol, but if the mixture has been subjected to the action of alcoholic potassium hydroxide, which is the case in the analysis of meat preparations, the starch retains some of this, and gelatinises when in contact with weak alcohol. In this case, the mixture should first be treated with water and sufficient acetic acid to impart an acid reaction and then mixed with excess of 96 per cent. alcohol to reprecipitate the starch and glycogen, leaving the potassium acetate in solution. The precipitate, after being washed with alcohol, is heated at 80° with 44 per cent. alcohol, the liquid is passed through a filter, and the residue washed four times by decantation with 49 per cent. alcohol. The alcoholic solutions are evaporated to a small bulk and the glycogen reprecipitated by adding an excess of 96 per cent. alcohol.

The starch, which is now free from glycogen, is dissolved in aqueous potassium hydroxide, the solution filtered, and then treated according to the conventional method.

L. DE K.

**New Apparatus for the Estimation of Volatile Acids in Wines.** By G. SELLIER (*Ann. Chim. anal.*, 1901, 6, 451—452).—Steam is generated in a wide-necked flask containing 50—60 c.c. of distilled water and heated over a spirit lamp. The flask is closed with another elongated flask which holds the 10 c.c. of wine used for the experiment, and is fitted inside with a small glass syphon, the longer limb of which just passes through the bottom of the flask into which it is fused. On boiling the water, a current of steam passes through the syphon into the wine and carries off the volatile acids, but little condensation taking place as the flask gets sufficiently heated by the steam. When about 5 c.c. of liquid are left, the heat is withdrawn, and on cooling, the wine is syphoned into the lower flask. The top flask is washed with 2 or 3 c.c. of water, which also passes through the syphon, and the fixed acids are then estimated by titration. The volatile acids are found by subtracting the fixed from the total acidity.

L. DE K.

**The Acids of Wine and the Diminution of Acidity.** By MÖSLINGER (*Zeit. Nahr.-Genussm.*, 1901, 4, 1120—1130).—The paper

is chiefly devoted to a study of the origin of lactic acid in wines. It appears to be a product of a secondary fermentation, affecting the sugar and also the malic acid which is partially removed. The lactic acid is estimated as follows: 50 to 100 c.c. of wine are freed from volatile acids by means of a current of steam, and the residual liquid rendered neutral to litmus with solution of barium hydroxide. Five to 10 c.c. of a 10 per cent. solution of barium chloride are added and the whole evaporated to 25 c.c. After making sure that the liquid is neutral, 95 per cent. alcohol is added until the volume is about 70–80 c.c., the liquid is then diluted to exactly 100 c.c. with alcohol, and filtered through a dry filter. Eighty c.c. of the filtrate are then evaporated in a platinum dish, the residue is burnt to a black ash, and its alkalinity estimated in the usual way. One c.c. of *N* acid = 0.09 gram of lactic acid.

Another good plan is to take 50–100 c.c. of wine, remove the volatile acids, and evaporate to a thin syrup with addition of 0.2–0.4 gram of tartaric acid. The solution is then introduced into a 50 c.c. graduated measure, diluted to 5 c.c., and gradually mixed with 95 per cent. alcohol until the volume is 30 c.c., when 20 c.c. of ether are added 10 c.c. at a time. When clear, the liquid is poured off, evaporated with addition of a little water, neutralised with barium hydroxide (no barium chloride is added), and treated as previously directed

L. DE K.

**Detection and Estimation of Oxalic Acid in Hydrogen Peroxide.** By D. A. ROCHE (*Chem. Centr.*, 1901, ii, 1279–1280; from *Mon. sci.*, [iv], 15, 11, 694. Compare Arth, *Abstr.*, 1901, ii, 622).—The author doubts whether oxalic acid frequently occurs in commercial hydrogen peroxide. To detect it, the sample, if its acidity exceeds 5 grams of sulphuric acid per litre, is partly neutralised with ammonia, mixed with ammonium acetate, and tested with a solution of calcium sulphate or chloride. If the acidity is less, there is no need to neutralise with ammonia. The estimation is carried out as follows: A quantity of the sample containing 0.1–0.2 gram of oxalic acid is diluted to 200 c.c. and the acidity is increased or reduced to about the equivalent of 2 grams of sulphuric acid per litre by adding either acetic acid or ammonia; 2 grams of ammonium acetate are added, and the oxalic acid precipitated with calcium acetate. The calcium oxalate is then titrated, as usual, with potassium permanganate. For accurate analysis, the calcium oxalate should be purified by reprecipitation.

L. DE K.

**Commercial Lemon Juices.** By R. SENDTNER (*Zeit. Nahr.-Genussm.*, 1901, 4, 1133–1140).—From the result of a number of analyses, it appears that genuine lemon juices should show about the following composition: sp. gr. 1034–1039; extract 8–10 per cent., consisting of citric acid 6–9 per cent., and mineral salts 0.3–0.5 per cent., the balance being made up of cupric reducing substances (sugar). The ash should have an alkalinity equal to 2.9–6 c.c. of *N* acid.

L. DE K.

**Separation of Glutamic Acid and Leucine by Gaseous Hydrogen Chloride.** By ALEXANDRE ÉTARD (*Compt. rend.*, 1901, 133, 1231—1233).—Glutamic acid and leucine, when present together in solution, can be readily separated by saturating with hydrogen chloride, when the insoluble hydrochloride of the former is precipitated.

The liquid products of the hydrolysis of albumins which have been neutralised and concentrated under reduced pressure, are fractionally precipitated with methyl alcohol. The two first precipitates are dissolved in a little water and saturated with hydrogen chloride; from this solution, nearly pure leucine hydrochloride can be obtained. The later precipitates are treated in the same manner; hydrogen chloride throws down a precipitate consisting of the hydrochloride of glutamic acid, free from salts of other amino-acids.

The glutamic acid obtained thus from veal formed orthorhombic crystals, melting at  $183^{\circ}$  and having  $[\alpha]_D + 0^{\circ}57'$ . K. J. P. O.

**Jolles's Process for the Estimation of Uric Acid in Urine.** By O. MAKOWKA (*Chem. Zeit.*, 1901, 25, 1159—1160).—Jolles's process (*Abstr.*, 1900, ii, 450) is recommended as the most complete, trustworthy, simple, and accurate method for the clinical estimation of uric acid in urines. L. DE K.

**Composition of Milk.** By H. DROOP RICHMOND (*Analyst*, 1901, 26, 310—316. Compare *Abstr.*, 1900, ii, 696).—A record of results obtained in the laboratory of the Aylesbury Dairy Co. *Mean Composition of the Milk in 1900.* 13,798 samples were analysed, and the average composition showed that both the solids (12.57 per cent.) and the fat (3.64 per cent.) were largely in excess of the legal requirements. *Accuracy of Methods used.* In most of the analyses, the fat was estimated by the Gerber method; the results obtained by this process agree within about 0.1 per cent. with those obtained by Adams' paper process, as shown by an analysis of 78 samples in duplicate. The fat, calculated from sp. gr. and solids, also agreed very well. Experiments were also made by drying on washed, or unwashed, chrysotile (Macfarlane's process) and then extracting the fat with ether; but the process was abandoned. *Variation in Fat during delivery of the Milk.* An empirical mathematical formula is given, from which it appears that the probable difference is only about 0.11 per cent., and that a difference exceeding 0.31 per cent. must be looked on with suspicion. *Variation of Constituents of Solids-not-fat.* A table is given showing that in normal milks any deficiency in solids not fat below 9 is due to lactose, and any excess to proteids. *Relation between the Proteids and Salts of Milk.* The ash may be calculated with reasonable accuracy from the proteids, using the formula  $A = 0.36 + 0.11P$ . Casein, as it occurs in milk, may be looked on as a substituted phosphoric acid combined with a molecular proportion of calcium phosphate. In the course of this investigation, it was found that milk, when passed through a porcelain filter, not only loses its casein, but the whole of its proteids.



*Acidity of Milk.* In boiled milk, this can only be caused by acid phosphates and citrates. The acidity of the milk added to the alkalinity of the ash, gives a datum for estimating the amount of citric acid. The acidity is 16.8 c.c. of *N* alkali per litre to phenolphthalein, and this, being due to acid phosphates, is equal to  $16.8 \times 2/0.97 = 34.6$  c.c. for chemical neutrality, which is equal to  $34.6 \times 0.063/1.032 \times 10 = 0.218$  per cent. of citric acid; if to this is added the 0.046 per cent. of citric acid corresponding with the alkalinity of the ash, a total of 0.264 per cent. is obtained. As very little calcium citrate is precipitated on boiling, it may be presumed that it exists in the milk as a dibasic salt. The citrates would account for 14.4 c.c. of *N* alkali, the remainder being accounted for by the acid phosphate; this is equivalent to 0.020 per cent. of phosphoric acid being present as mono- and 0.077 per cent. as dibasic phosphate.

Contrary to the views expressed by Söldner, the author believes that one-third of the base with which casein is combined in milk is sodium and not calcium, that casein forms a molecular compound with calcium phosphate, and that the citrates are present as dibasic and not as tribasic salts; hence the disagreement between Söldner and the author as regards the proportions of mono- and dibasic phosphates.

L. DE K.

*Relation between Specific Gravity, Fat, and Solids not Fat in Milk.* By NORMAN LEONARD (*Analyst*, 1901, 26, 318—319).—A recalculation, by the method previously employed (*Abstr.*, 1900, ii, 376), of the values of the constants  $\sigma$  and  $\phi$  in Richmond's formula  $G/D = S\sigma - F\phi$  (*Analyst*, 1888, 14, 121—131), where  $D$  is the density of milk (water = 1). The formula now becomes  $G/D = 3.7758 - 0.743F$  or  $F = 0.836T - 0.221G/D$ . No practical advantage is claimed for this improved formula; in fact, the author's old formula,  $F = 0.827T - 0.212G$ , seems to be more suitable when dealing with rich milks.

L. DE K.

*Calculation of the Simultaneous Addition of Water to, and Withdrawal of Cream from, Milk.* By V. GÉNIN (*Compt. rend.*, 1901, 113, 743—745).—The method of calculation is based on the fact that the specific volume of the butter has a nearly constant relation to the other characters of milk.

N. H. J. M.

*Detection of Adulterations with Margarine by the Sesamé Oil Reaction.* By PAUL SOLTSIEN (*Chem. Centr.*, 1901, ii, 1240—1241; from *Pharm. Zeit.*, 46, 850).—Both the sugar and furaldehyde reactions are valuable, but the stannous chloride test is less liable to give erroneous results if properly conducted. Long contact between stannous chloride and the melted fat should be avoided, and the emulsion should be caused to separate as quickly as possible by plunging the tube in water at 60°; the mixture should not, on any account, be shaken again. As soon as the tin solution has separated, the lower part of the test-tube containing it is placed in boiling water. The reaction, however, generally takes place immediately after the separation of the two layers. The test also succeeds, although in a less degree, with the fatty acids.

L. DE K.

**Analysis of Oils.** By ALESSANDRO CUTOLO (*Rev. Intern. Falsif.*, 1901, 14, 146—148).—The author has modified the nitric acid test. One gram of colourless gelatin is heated in a test-tube with 10—15 c.c. of nitric acid of sp. gr. 1.4 for a few minutes in the water-bath; when cold, the liquid is diluted to 100 c.c. with nitric acid.

One c.c. of the reagent and 5 c.c. of the suspected oil are mixed in a test-tube and heated to boiling; after removing the source of heat and waiting for one or two minutes, the tube is cooled. The colours of both the fatty mass and the acid are then observed. The following results have been obtained:—*Almond oil*, fat white, acid colourless; *nut oil*, fat white, acid colourless; *olive oil*, fat clear yellow, acid faintly coloured; *castor oil*, fat orange-yellow, acid colourless; *sesamé oil*, fat orange, acid intensely yellow; *linseed oil*, fat orange-red, acid faintly coloured; *apricot oil*, fat red, acid faintly coloured; *cotton-seed oil*, fat reddish-brown, acid faintly coloured; *hemp-seed oil*, fat reddish-brown, acid faintly coloured; *colza oil*, fat reddish-brown, acid faintly coloured; *poppy oil*, fat brown, acid faintly coloured; *grape stone oil*, fat brown, acid faintly coloured.

Tables are also given showing the acidity and refraction of 40 samples of olive and 12 samples of cotton-seed oil.

L. DE K.

**Proportion of Liquid Fatty Acids in some Fats and Oils, and their Iodine Values.** By N. J. LANE (*J. Soc. Chem. Ind.*, 1901, 20, 1083).—Boiling light petroleum is substituted for boiling ether in the separation of lead oleates from the lead salts of the saturated fatty acids, and a large number of fats and oils have been tested by the new process. The proportion of oleic acids thus found is a trifle lower than that given by the ether method, whilst the iodine absorption is a little higher.

L. DE K.

**Detection of Vegetable Fats in Animal Fats by the Phytosteryl Acetate Test.** By A. BÖMER (*Zeit. Nahr.-Genussm.*, 1901, 4, 1070—1095. Compare this vol., i, 30).—The crude cholesterol from 100 grams of the fat, after being tested microscopically for phytosterol, is heated to boiling with 2—3 c.c. of acetic anhydride for a quarter of a minute in a dish covered with a watch-glass, and the excess of acid evaporated on the water-bath. The crude mixed acetates are then recrystallised several times from boiling absolute alcohol, and after the third and following crystallisations the melting point is carefully taken. If this exceeds 116° or 117° (corr.) the sample operated on contains an admixture of vegetable fat.

Reference must be made to the original for the large amount of detailed observations on which the method is based.

The author calls attention to the necessity of correcting the readings of the thermometers in this and other cases where only small differences in melting points are used as criteria of purity. L. DE K.

**Calculation of the Percentage of Diglycerides in Fat Mixtures containing Hydroxy-fatty Acids.** By J. FREUNDLICH (*Chem. Zeit.*, 1901, 25, 1129).—The following formula for the calculation is given:  $D = M.[1683(100 - F) - 38d]/51.612$ , in which  $d$  is

the ether number of the fat-mixture,  $F$  the percentage of total fatty acids (or in the absence of soluble acids, the Hehner number),  $M$  the molecular weight of the diglyceride, and  $D$  the percentage of the same. The formula may also be applied in the absence of hydroxy-fatty acids.

L. DE K.

**Analysis of Waxes; Estimation of Resin; Analysis of Factitious Wax; Wool Wax.** By FERDINAND JEAN (*Ann. Chim. anal.*, 1901, 6, 447—451).—One gram of the sample is heated with alcohol on the water-bath until melted, the mixture shaken, and allowed to cool slowly, when the undissolved matter is collected on a tared filter, and washed with alcohol until free from acidity. After drying first in the air and then over sulphuric acid, the residue, which may consist of wax, tallow, and paraffin, or ceresin, is weighed; the loss in weight represents stearic acid and resin which have dissolved in the alcohol.

To estimate the resin, the alcoholic solution is evaporated nearly to dryness, and the residue redissolved in ether, and shaken with zinc oxide, which forms an insoluble zinc stearate, but a soluble zinc resinate. The solution is then shaken in a separating funnel with dilute hydrochloric acid, a few c.c. of light petroleum are added, and the whole is again shaken, and allowed to settle. After removing the acid layer, the ether is washed with a little water and evaporated, and the residual resin dried at 100° and weighed. To the weight obtained, a correction of 1.6 per cent. must be made.

In judging the quality of a sample by the amount of potassium hydroxide required to neutralise the acidity and saponify the esters, due regard should be paid to the amount of alkali absorbed by the resin and stearic acids, and also to that required for the saponification of the tallow; the latter may be calculated from the glycerol obtained on saponification. In the absence of true wax, tallow and paraffin may be separated by boiling with alcoholic alkali and dissolving the unsaponified paraffin in ether.

Two analyses are given of adulterated waxes, one being adulterated with rosin, stearic acid, and paraffin, and the other being composed entirely of stearic acid, rosin, tallow, and paraffin. An analysis is also given of a sample of wool wax, which much resembled yellow bees-wax in appearance. It consisted of 47 per cent. of free fatty acids, 50 per cent. of unsaponifiable fat, and 2 per cent. of neutral saponifiable fat.

L. DE K.

**Estimation of Furfuraldehyde in Pepper.** By ALBERT HILGER (*Zeit. Nahr.-Genussm.*, 1901, 4, 1141—1142).—Five grams of ground pepper are completely extracted with alcohol and ether, and then distilled with 100—150 c.c. of hydrochloric acid of 1.06 sp. gr.; more acid is gradually added, and the boiling continued until 400 c.c. of distillate are collected. During the distillation, a current of carbon dioxide is passed through the apparatus.

The distillate is cooled and slowly neutralised with aqueous sodium hydroxide, then slightly acidified with acetic acid; a current of carbon dioxide is passed, and a solution of 2 grams of phenylhydrazine hydro-

chloride and 3 grams of sodium acetate in 20 c.c. of water is added with constant stirring. The osazone is collected in an Allihn's tube and washed with 100 c.c. of water; it is then dissolved in absolute alcohol and evaporated in a platinum dish at 60–70° under reduced pressure and finally weighed.

L. DE K.

**A new Ureometer.** By LÉON FREDERICQ (*Trav. du lab. de L. Fredericq, Liège*, 1901, 6, 132–134; from *Vol. jubilaire de la Soc. de Biol.*, 1889).—A new ureometer, a modification of Yvon's, is described and figured. The discredit into which the hypobromite method of estimating urea has fallen is not entirely justifiable.

W. D. H.

**The Alkalimetric Factors of some Diacid Alkaloids.** By HARRY M. GORDIN (*Arch. Pharm.*, 1901, 239, 645–647).—Control estimations made with pure materials by the author's method (*Abstr.*, 1900, ii, 119) show that with quinine and quinidine good results are obtained, but with cinchonine and cinchonidine the results are 5 per cent. too low, the calculation being made on the assumption that the precipitate has the composition  $\text{AlK}, \text{HI}, \text{I}_n$  [ $\text{AlK} = 1$  mol. alkaloid].

C. F. B.

**Characteristic Reaction of Morphine.** By GUSTAVE FLEURY (*Ann. Chim. anal.*, 1901, 6, 417–418).—A particle of the suspected alkaloid, of the size of a pin's head, is placed in the centre of a saucer and dissolved in a drop of dilute sulphuric acid (1:20). A little lead dioxide is added and the mixture stirred for 6 or 8 minutes. After waiting for another 3 or 4 minutes, the lead dioxide has deposited, and a clear drop of liquid may be obtained by inclining the dish. On adding a drop of ammonia, a brown coloration at once makes its appearance.

L. DE K.

**Detection of Indican in Urine.** By CASIMIR STRZYŻOWSKI (*Chem. Centr.*, 1901, ii, 1181–1182; from *Oesterr. Chem. Zeit.*, 4, 465–468).—Amann's process for the quantitative estimation of indican in urine (*Abstr.*, 1898, ii, 659) is untrustworthy; the statement that albumin is not precipitated by persulphates is erroneous. Graziani's process is a useful one. Two or three c.c. of a mixture of two drops of officinal solution of ferric chloride in 50 c.c. of sulphuric acid are carefully poured down the side of a test-tube containing 5–10 c.c. of urine. According to the amount of indican present, a cherry-red, violet, or blue ring will make its appearance at the place of contact.

The author has worked out another method. If the sample has a sp. gr. over 1.015, 20 c.c. are mixed with 10 c.c. of a 10 per cent. solution of lead acetate; if below 1.015, 5 c.c. of lead solution are added, and then 5 c.c. of water. Fifteen c.c. of the clear filtrate are mixed with a drop of 1 per cent. solution of potassium chlorate, then with 5 c.c. of chloroform, and finally with 15 c.c. of pure fuming hydrochloric acid. On shaking for 10–15 minutes, the maximum coloration is obtained. If the chloroform is distinctly blue, another drop of chlorate may be added, and the shaking repeated to see whether the blue colour may yet increase, but as a rule it will be found that the one drop is sufficient. From the intensity of the colour, in conjunc-



tion with other data, it is possible to judge whether indican is present in normal or in abnormal amount.

L. DE K.

**Detection of Artificial Sweetening Materials in Beer.** By A. SARTORI (*Chem. Zeit.*, 1901, 25, 953).—The author states that the test for "saccharin," dulein, and similar sweetening materials by Morpurgo's process (acidifying with phosphoric acid and shaking with a mixture of ether and light petroleum; *Abstr.*, 1898, ii, 359) is not interfered with by the presence of sucrose, dextrose, starch-sugar, lactose, malt-extract, glycerol, mannitol, dextrin, honey, or extract of dates, figs, or liquorice, none of these passing into the ethereal solution.

L. DE K.

**Apparatus and Method for Estimating the Extractive Matter in Kiln-dried Malt.** By A. GAWALOWSKI (*Zeit. anal. Chem.*, 1901, 40, 641—643).—A usual method of estimating the extractive matter of malt is to mix 10 grams of the ground malt with 100—150 c.c. of cold water, and digest in the cold for an hour, then heat to 55° and raise the temperature at the rate of 1° per minute to 75°, at which it is maintained until a drop, tested with iodine solution, shows that all the dextrin is converted into sugar. The mixture is then boiled, cooled, and made up to 533 grams, the assumption being made that the exhausted grains amount to 33 grams, which, however, is not universally true. In the filtered wort, the amount of extractive matter is ascertained either aërometrically, or, better, by evaporation and weighing. The mashing is better conducted under a slight pressure, and, with the object of being able to remove samples for testing without impairing the pressure, an apparatus has been devised consisting of a stout glass flask of 1½ litres capacity with a screw thread in the neck so that a cork can be screwed in. The cork carries three tubes, all furnished with stopcocks. One tube descends to the bottom of the flask and serves for withdrawing samples. A second is connected with a manometer; the third, which opens just below the cork, allows the wort to be drawn off when the flask is inverted. In this flask, 100 grams of malt are mashed with 1 litre of water at the temperatures above stated: the pressure should not exceed 3/4 of an atmosphere. When a sample shows the absence of dextrin, the temperature is raised to 100°. After cooling, the wort is drawn off and its contents estimated. This method requires no assumption to be made respecting the percentage of the exhausted grains, and obviates the troublesome washing out of the extractive matter which the open mashing involves if the percentage of the exhausted grains is unknown.

M. J. S.

**Rapid Technical Analysis of Pale and Dark Peats.** By HUGO BORNTÄGER (*Zeit. anal. Chem.*, 1901, 40, 639—641).—Nitrogen, moisture, and woody fibre are the only substances estimated. Moisture is estimated by drying at 110°; air-dried peat contains about 20 per cent. Pale coloured peat (5 kilograms) is heated with water (2 kilos.) at 5 atmospheres pressure for 5 hours in a digester (Dampf-Druckfilter); the insoluble fibres are pressed with a screw-press, dried at 110°, and weighed. The evaporated extract yields about 22

per cent. of a saccharin substance, which can be used as a feeding stuff for cattle (compare D.R.-P. 122193).

Dark peat, from which sugar is not obtainable, is similarly digested with addition of 800 grams of potash. The fibre is weighed as before, and the difference is regarded as humic acid; the proportion varies from 25 to 60 per cent. The humic acid is a valuable disinfectant; it is also the constituent on which the calorific value of a peat chiefly depends.

M. J. S.

**The Red Solution of Gold as a Reagent for Colloids.** By RICHARD ZSIGMONDY (*Zeit. anal. Chem.*, 1901, 40, 697—719).—The red solutions of metallic gold, obtained by reducing auric chloride by formaldehyde in presence of a weak alkali (Abstr., 1898, ii, 522), which the author regards as colloidal solutions (Abstr., 1900, ii, 397), become blue when mixed with sodium chloride (also other salts, acids, and alkalis), in consequence of an agglomeration of the particles of gold. This change of colour is prevented by the presence of a sufficient quantity of certain other colloids, and a classification of colloid substances can be made according to the amount required to prevent the change of colour, since the differences amongst them have a very extensive range. The author suggests the establishment of a "gold number," as a characteristic of each class of colloids, the process of estimation being as follows.

*Preparation of the Reagent.*—120 c.c. of water (twice distilled through a silver condenser) are boiled up in a Jena glass beaker; 25 c.c. of a 0.6 per cent. solution of chloroauric acid, ( $\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$ ), and 3—3.5 c.c. of 0.18*N* potassium carbonate, and then, slowly, 3—5 c.c. of a solution of commercial formalin (0.3 c.c. in 100 c.c. of water) are added. The red colour is developed in a few seconds. Turbid or purplish solutions are only fit for qualitative testing.

*Mode of Testing.*—The solution of the colloid (not more than 2 c.c.) is mixed with 10 c.c. of the gold solution and then 1 c.c. of a 10 per cent. solution of sodium chloride is added. The change of colour, if any, occurs immediately, and fresh experiments with different amounts of the colloid solution are made until the quantity is ascertained, which is just insufficient to prevent the change of colour. The results are expressed in milligrams of the colloid employed.

In the first or most active class, substances are placed which have a gold number of 0.005—0.1, such as gelatin. The second class contains substances of which 0.1—10 mg. are required, such as gum arabic, egg-albumin, tragacanth, and Iceland moss. Substances are placed in the third class, when 10—500 mg. are necessary, dextrin and potato starch, for instance. The fourth class contains such substances as colloidal silicic acid, which, in any quantity, will not prevent the change of colour.

Solutions should be examined when freshly prepared; all colloidal solutions seem to diminish in activity with age, although at very different speeds. Various applications of the new method are suggested.

M. J. S.

2009

## General and Physical Chemistry.

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**Use of Helium in Spectroscopy.** By ARMIN TSCHERMAK *Pflüger's Archiv*, 1901, 88, 95—97).—The author recommends the bright lines produced by the incandescent helium spectrum in a Plücker tube containing aluminium electrodes as one of the most convenient methods for wave-length determinations. The following lines are visible and most are well developed: 707, 688, 587·6, 502, 495, 470, 446. The same apparatus is also recommended as a source of light in determination of refractive indices, &c. J. J. S.

**Banded Flame Spectra of Metals.** By WALTER NOEL HARTLEY and HUGH RAMAGE (*Sci. Trans. Roy. Dublin Soc.*, 1901, [ii], 7, 339—352).—A continuation of previous work (*Phil. Trans.*, 1894, 185, A, 161—212). Metals of very different characters belonging to different groups in the periodic system yield banded spectra or spectra showing both bands and distinct lines. Examples are magnesium, zinc, and cadmium; copper, silver, and gold; aluminium, indium, and thallium; palladium and iridium; bismuth, tin, and lead. Banded spectra are given by metals which are combustible with large development of heat forming slightly volatile oxides, by metals yielding easily volatile oxides, and by metals that do not form oxides at the temperature of the flame. Certain groups of elements (copper, silver, and gold; aluminium and indium; beryllium and lanthanum) give banded spectra which are degraded towards the less refrangible rays; in other spectra (magnesium, zinc, cadmium), the bands are degraded on the other side. The flame spectra of palladium and iridium show many lines, independent of the fine lines making up the bands: this feature is probably connected with the difficulty of volatilising these metals in the oxy-hydrogen flame. Elements belonging to the same group in the periodic system exhibit similarly constituted banded spectra; hence similarly constituted molecules of the elements have similar modes of vibration, whether at the lower temperature of the flame or at the higher temperature of the arc. J. C. P.

**Spectra of the Rare Earths.** By ABRAHAM LANGLET (*Bihang K. Svenska Vet.-Akad. Handl.*, 1901, 26, ii, No 2, 1—16).—From a number of observations on the spectra of solutions of praseodymium salts, the author draws the following conclusions. For concentrated aqueous solutions of praseodymium salts, Bunsen's law concerning the relation between the intensity of the absorption bands and the optical concentration does not hold good. In concentrated solutions, the absorption in the yellow is both relatively and absolutely weaker than with dilute solutions, whilst the absence of maxima makes the bands more indistinct. The same action is observed with many ammonium and lanthanum-ammonium salts, whilst lanthanum salts show a similar but slighter action. The presence of a large quantity of

nitric acid weakens all the absorption bands with the possible exception of the last band in the blue; here also the absorption in the yellow is affected to the greatest extent. Solutions of praseodymium carbonate and tartrate in alkalis yield perfectly identical spectra, which, however, differ considerably from those of salt solutions of the same concentration. Benzene solutions of organic praseodymium compounds give varying spectra, which also differ widely from those of the neutral salts.

T. H. P.

**Ultra-violet Absorption Spectra.** By G. PAUL DROSSBACH (*Ber.*, 1902, 35, 91—93).—The author, in determining how far certain substances (mostly in 10 per cent. solution) absorb the ultra-violet rays, finds a marked absorption in the case of some salts of heavy metals, nitrates, and organic substances with high molecular weight. Hydrochloric acid, sulphuric acid, potassium chloride, chlorate and sulphate, sodium and calcium chlorides, aluminium and manganese sulphates, are found to be colourless, that is, light up to  $230\mu$  passes through these as easily as through water. In the following cases, where absorption takes place, the number gives the length of the shortest wave which can pass through: nitric acid, 340; oxalic acid, 294; potassium carbonate, 244; potassium oxalate, 294; potassium nitrate, 340; ammonia, 272; barium chloride, 236; barium nitrate, 340; aluminium nitrate, 340; zinc chloride, 290; ferrous sulphate, 394; ferric chloride, 400; nickel chloride, 400; lead acetate, 294; chromium chloride, 390; uranium chloride, 400; manganese nitrate, 340; copper sulphate, 296. It is to be noted that the salts of colourless metals give the spectra of the corresponding acids; thus the limit for all such nitrates is 340.

J. C. P.

**Radioactive Substances.** By P. CURIE and SŁODOWSKA CURIE (*Compt. rend.*, 1902, 134, 85—87).—The various observations hitherto made show that in the case of uranium, thorium, radium, and probably actinium, the radioactivity is always the same when the radioactive substance is brought into the same chemical and physical state, and it does not vary with the time. If, by any particular treatment, the substance loses some of its activity, it subsequently regains it in course of time. Polonium behaves differently from other radioactive substances. The absence of any evidence that the intensity of the radioactivity diminishes with time, or that the substances undergo any loss of weight, indicates that the energy of the radiation may either be derived from heat radiations in some manner contrary to Carnot's principle, or from some other source, possibly radiations not hitherto recognised by any other means.

C. H. B.

**Existence of Rays which undergo Reflection in the Radiations emitted by a Mixture of Chlorides of Radium and of Barium.** By THOMAS TOMMASINA (*Compt. rend.*, 1901, 133, 1299—1301).—The author shows that some of the radiations can be reflected by a parabolic mirror of silvered copper, the reflection being evidenced by increase in the rate of discharge of an electroscope.

L. M. J.



**Law of Transparency of Matter for X-Rays.** By L. BENOIST (*J. Physique*, 1901, 10, 653—668).—As a measure of the transparency, the author has determined for a large number of compounds and elements what he terms the equivalent of transparency, which is the mass in decigrams of a prism having a base of 1 sq. cm. which, when traversed along its axis by the X-rays, produces the same absorption as a prism of paraffin 75 mm. in height. It is found that the specific opacity of a substance is independent of its physical state, this being verified for bromine, ethyl bromide, methyl iodide, and other compounds; it is, further, independent of temperature, and holds for the crystalline and amorphous states. The opacity is further independent of the atomic or molecular grouping, being, hence, equal for isomerides, polymerides, or various allotropic forms. It is independent of combination of the atoms, being a *purely additive quantity*, so that the opacity of a compound may be readily calculated. Thus, if  $M$  is the total mass of a compound or mixture and  $E$  its equivalent of transparency, and  $m_1 m_2 \dots e_1 e_2 \dots$  are the similar constants for the components, then  $\frac{M}{E} = \frac{m_1}{e_1} + \frac{m_2}{e_2} \dots$  and various illustrative examples are given, thus quartz, calculated from the values of silicon and oxygen, should have the equivalent 24; that found was 24.1. The opacity increases with the atomic weight, and a curve constructed with the equivalents of transparency as ordinates against atomic weight as abscissæ is perfectly continuous, being of form approximating to a hyperbola. It is evident, hence, that the equivalent might be of use in determining an atomic weight, and it is shown, for example, that the atomic weight of indium must be very nearly equal to those of silver and cadmium. The transparency varies with the nature of the rays, but it is remarkable that this variation is very slight for silver and elements the atomic weights of which lie near its value. The author suggests also that this purely additive quantity might be of use in certain cases of quantitative analysis.

L. M. J.

**Behaviour of Aldehydes and Ketones towards Tesla-rays.** By HUGO KAUFFMANN (*Ber.*, 1902, 35, 473—483).—Aldehydes and ketones alone amongst aliphatic compounds resemble certain aromatic compounds in emitting blue light when exposed to Tesla-rays. The carbonyl group is responsible for this effect, which is very marked in the case of formaldehyde as well as in the ketones where the carbonyl is linked to two carbon atoms, but no such effect is produced by the carbonyl group in acids, esters, anhydrides, or amides. The effect also disappears in the case of aldehydes and ketones as soon as the carbonyl group is displaced, as in acetoxime and the acetals.

The intensity of the radiation is diminished by increasing the number of carbon atoms in the molecule, by the entrance of a carbethoxy-group, and in a still more marked degree by the introduction of a phenyl group. Diacetyl and acetylacetone are luminescent, showing that amongst aliphatic compounds, colour and luminescence can occur together, but acetylacetone shows no luminescence, possibly by reason of its conversion into an enolic modification. Saturated ring-ketones are luminescent, but not those which contain double linkings.

Like the benzene nucleus, it is probable that the carbonyl group can exist in an active or in an inactive condition, and that this determines the presence or absence of luminescence; chemical activity and luminescence would then be parallel phenomena.

T. M. L.

**Importance of Electrical Methods and Theories in Chemistry.** By WALTHER NERNST (*Zeit. Elektrochem.*, 1901, 7, 1004—1006).—After passing in review the well-known theories of electrochemistry, the author points out that they all lead to the view that electricity consists of positive and negative electrons, which may combine (1) with matter to form compounds (the ions) which differ widely from the original matter, or (2) with each other to form a neutral electron molecule. This leads to the following theory of chemical combination; all elements and radicles possess affinity for positive or negative electrons, with which they unite to form the ions; they also possess non-polar attraction for each other, to which the formation of compounds of the metals, of hydrogen molecules, of iodine chloride, for example, is due. When a positive element combines with a negative one, however, an electron molecule is added, and this separates into its positive and negative electrons when the molecule is ionised. Such compounds differ much more from their constituents than those which contain no electron molecule. For example, the compounds of metals are metallic, those of non-metals retain the characters of non-metals, whilst a compound of a metal and a non-metal is a substance belonging to a new class altogether. It is possible that elements exist which combine with the positive electrons, without the negative electrons being simultaneously taken up by another substance; in this case, the negative electrons might be set free and appear as the Becquerel rays.

T. E.

**Electrode Potentials.** By FRITZ HABER (*Zeit. Elektrochem.*, 1901, 7, 1043—1053).—The potentials of metallic or non-metallic electrodes are usually expressed in a uniform way, but this is not the case with the so-called oxidation and reduction electrodes. By means of the following formula, the derivation of which is given, all electrode potentials ( $E$ ) may be expressed in a uniform manner:

$$E = \frac{RT}{\nu F} \left[ \log K - \log \frac{[A']^{m'} [B']^{n'} \dots}{[A]^m [B]^n \dots} \right],$$

where  $\nu$  electrons,  $F$ , are taken up in the conversion of  $m'$ ,  $n'$  ... molecules of the substances  $A'$ ,  $B'$  ... in the concentrations  $[A']$ ,  $[B']$ , &c., into  $m$ ,  $n$ , &c., molecules of the substances  $A$ ,  $B$ , &c. This applies to an oxidation; for a reduction, the sign is changed throughout the equation, the sign of  $E$  applying always to the solution.  $K$  is the equilibrium constant of the reaction occurring at the electrode. When all the concentrations of the gaseous and dissolved substances are unity, the second logarithm disappears and  $E = RT/\nu F \log K = ep_T$ , where  $ep_T$  is what Wilsmore (*Abstr.*, 1901, ii, 2 and 142) has called the electrolytic potential at temperature  $T$ . This may be referred to the hydrogen electrode, or to the absolute value of the calomel electrode. The detailed application of the equation to the more important cases which have been investigated, which is made in the original, does not admit of brief abstraction.

T. E. J

**Electromotive Force of Metals in Cyanide Solutions.** By S. B. CHRISTY (*Chem. Centr.*, 1901, ii, 1326; from *Elektrochem. Zeit.*, 1901, 8, 181—186).—The electromotive force of a cyanide solution against copper decreases with decrease of concentration. For potassium cyanide against copper, the values are +0.9 volt for *N* solutions and -0.3 volt for *N*/1,000,000 solutions; for zinc, the values similarly decrease from +1 volt to -0.6 volt; for gold from 0.4 volt to -0.622 volt. With the latter metal in *N* potassium chloride and *N* potassium hydroxide solutions the values are respectively -0.487 and -0.381.

L. M. J.

**Electrolysis of Alkali Chlorides with Carbon Anodes.** By L. SPRESSER (*Zeit. Elektrochem.*, 1901, 7, 971—976, 987—994, 1012—1017, 1027—1035, 1071—1076, and 1083—1093).—The nature, extent, and causes of the deterioration of carbon anodes of different kinds when used in the electrolysis of solutions of alkali chlorides are investigated very fully. Cells with and without diaphragms were used, and the solution always contained more or less chlorate and hypochlorite.

The attack of the carbon is mainly due to oxidation, chlorination occurs sometimes with carbons containing volatile matter, but it is in general of very little importance. The principal oxidation product is carbon dioxide; considerable disintegration of the carbon always occurs, the loss due to which may exceed that due to the chemical action. The difference between the results of experiments with and without diaphragms is one of degree, the concentration of the hypochlorite and the oxidation being smaller in the former case.

In sulphuric acid (about 20 per cent.  $\text{H}_2\text{SO}_4$ ), more than 90 per cent. of the oxygen separated at the anode is used in oxidation of the carbon, about half of it yielding carbon dioxide, and the remainder, probably colloidal, humus-like substances which colour the acid brown (the same products are formed with the other electrolytes although in different proportions). The mechanical disintegration of the carbon is very marked. With a 16 per cent. solution of sodium hydroxide, both oxidation and disintegration are less than with sulphuric acid, and different specimens of carbon behave differently, which was not the case with the acid. There is no direct relation between the behaviour of carbon in the different solutions. Rise of temperature always accelerates the destruction of the carbon.

The author explains the characteristic behaviour of the carbon anodes by their porous nature. When a solution of an alkali chloride is electrolysed, the Cl ions within the pores of the carbon are soon discharged, and since they cannot be rapidly replaced by diffusion, a point is soon reached at which OH ions are discharged. This only occurs within the pores, because the circulation of the electrolyte at the surface of the anode keeps up a sufficient supply of Cl ions there. The carbon is therefore oxidised mainly within the pores, which explains the disintegration observed. The disintegration is not due to the escape of gas, because a carbon cathode does not disintegrate. In similar circumstances, much more oxygen is evolved from a carbon anode than from one of platinum, a fact readily explained by the

author's hypothesis. This is strikingly exemplified by a series of experiments with hydrochloric acid in which the quantity of oxygen evolved increases with the porosity of the carbon anode used. That the concentration of hypochlorite attainable at a carbon anode is much smaller than at one of platinum is also in agreement with the theory, because for each OH ion discharged a H ion must remain in solution. This is equivalent to the formation of a molecule of hydrogen chloride, which decomposes an equivalent quantity of hypochlorite. A carbon anode undergoes great disintegration in sulphuric acid of moderate concentration, but is very little disintegrated in concentrated acid; since the discharge of  $\text{SO}_4$  ions within the pores of the carbon increases the strength of the acid contained in them, it will be a better or worse conductor than the main body of the acid according as this is weaker or stronger than the acid of maximum conductivity. The pores will therefore be more exposed to attack in weak acid and less exposed in strong acid.

The formation of hydrogen chloride at carbon anodes may be explained by the reaction  $2\text{HOCl} + \text{C} = 2\text{HCl} + \text{CO}_2$ . The author shows that this change really occurs with considerable velocity, but inclines to the view that his own hypothesis is preferable as being more generally applicable.

Generally speaking, the less porous a carbon the more suitable it is for use in the electrolysis of solutions of alkali chlorides, but the only satisfactory test of the suitability of a carbon is a prolonged experiment with it under working conditions. T. E.

**Electrocapillary Maxima of some Organic Compounds.** By A. GOUY (*Compt. rend.*, 1901, 133, 1301—1303).—The depression of the electrocapillary maximum by the dissolution of various organic compounds was studied, and it was found that the depression increases less rapidly than the concentration. The maxima with liquids almost anhydrous and only containing sufficient water to render them conductive were also found. Fifty liquids were examined and it was observed that in general the depression is greatest for "active" compounds. With these also, the depression is only double or treble what is obtained in solutions of about 1 per cent., a fact which further supports the supposition of the accumulation of the active ions at the mercurial surface (*Abstr.*, 1901, ii, 83).

L. M. J.

**Apparatus for the Demonstration and Determination of Ionic Mobilities.** By RICHARD ABEGG (*Zeit. Elektrochem.*, 1901, 7, 1011—1012).—A somewhat simplified form of the apparatus used by Steele (*Trans.*, 1901, 79, 414) is described. The tubes are enclosed in a vessel, with plate glass sides, containing water, so that the movement of the boundary surfaces of the solutions can be shown to an audience by means of the lantern. T. E.

**Thermometer of Light Petroleum.** By L. BAUDIN (*Compt. rend.*, 1901, 133, 1207).—The author has successfully employed a thermometer in which the liquid is light petroleum, of sp. gr. 0.647 at  $15^\circ$ , to record temperatures as low as that of liquid air, in which



it remains unfrozen. The graduation was obtained by the use of melting ice, and boiling methyl chloride, nitrous oxide, and oxygen.

L. M. J.

**Method of determining Latent Heat of Evaporation.** Latent Heat of Evaporation of Pyridine, Acetonitrile, and Benzonitrile. By LOUIS KAHLBERG (*J. Physical Chem.*, 1901, 5, 215—232).—The method is practically identical with that employed by Berthelot (*Abstr.*, 1878, 106), the only essential difference being the use of an electric current for heating the liquid. The values obtained for the specific heat and latent heat of evaporation of the carefully purified compounds are as follows: Pyridine, specific heat, 0.4313; latent heat, 104.0; acetonitrile, specific heat, 0.5333; latent heat, 173.6; benzonitrile, specific heat, 0.4369; latent heat, 87.7. The values obtained for the boiling point constants by use of these numbers are respectively 28.8, 48.67, and 14.39, agreeing fairly with those calculated by Trouton's rule, namely, 29.5, 45.7, and 13.9. L. M. J.

**Critical Constants and Molecular Complexity of Hydrocarbons.** By PHILIPPE A. GUYE and ED. MALLET (*Compt. rend.*, 1901, 133, 1287—1290).—The following values have been obtained by the authors:

	$T_c$ .	$p_c$ .	$K_c$ .	$a \times 10^{-6}$ .	$b$ .
Durene .....	675.5	28.6	23.62	45.36	242.4
Diphenylmethane .....	770.0	28.2	27.30	38.25	224.1
Diphenyl.....	768.6	31.8	24.17	52.81	248.0
Naphthalene .....	741.2	39.2	18.89	39.79	193.8

$T_c$  is the absolute critical temperature,  $p_c$  the critical pressure in atmospheres,  $K_c$  the critical coefficient =  $T_c/p_c$ ;  $a$  and  $b$  are the values of these constants in Van der Waals' equations calculated for the molecular weight in grams, volumes being expressed in cubic centimetres. To determine molecular complexity in liquid and vapour phases, the following quantities are examined: (1) Ratio of molecular refraction  $(n^2 - 1)M/(n^2 + 2)D$  to the critical coefficient  $K_c$ . (2) Ratio of the real to the theoretical critical density. (3) The value of the constant  $(\log p_c - \log p)T/(T_c - T)$ , where  $T$  is the boiling point at pressure  $p$ . The values of these three quantities are respectively, durene, 1.86, 4.09, 3.17; diphenylmethane, 1.96, 4.08, 3.29; diphenyl, 2.05, 4.26, 3.27; naphthalene, 2.22, 3.88, 3.13.

Polymerisation may be established by the following. The liquid is polymerised at the critical point if the ratio (1) is distinctly below 1.8 and (2) greater than 4.0. The complexity is normal between boiling point and critical point if (1) = about 1.8, (2) = about 3.9 or 4, and (3) = about 3.1. If, however, (3) is greater than 3.1, it indicates polymerisation of the liquid phase at low temperatures with depolymerisation in the vapour phase at the critical temperature. The hydrocarbons examined hence appear normal from ordinary conditions to the critical conditions.

L. M. J.

† **Criticisms on Melting Point Determinations.** By M. C. SCHUYTEN (*Chem. Centr.*, 1901, ii, 1326; from *Hand. vijfde Vlaamsch*

*Natur-Genesskund. Congres.*, 1901).—Values given by different observers for the melting point of a compound frequently differ greatly and the observed melting point is influenced considerably by conditions of the experiment, such as size of flame, rapidity of heating, nature of the thermometer glass, &c. With stearin, the author obtained results varying from 27° to 57·5°, and he considers that most of the melting point data are not absolutely trustworthy. L. M. J.

**Determination of the Solidifying Point of Fats.** By AL. A. SHUKOFF (*Chem. Zeit.*, 1901, 25, 1111—1112. Compare Abstr., 1899, ii, 588).—The author now recommends a modification of the apparatus previously used (*loc. cit.*) for the determination of the solidifying point of fats and oils. For substances which solidify below the ordinary temperature, an apparatus closely resembling Beckmann's apparatus for cryoscopic measurements is used. The temperature of the cooling liquid in the outermost vessel must only be 2° or 3° below the solidifying point of the substance under investigation. K. J. P. O.

**Minimum Boiling Points and Vapour Composition. II.** By MORRIS R. EBERSOLE (*J. Physical Chem.*, 1901, 5, 239—255).—A continuation of a previous paper by Pettit (Abstr., 1899, ii, 632). Ryland's observation (Abstr., 1900, ii, 64) that acetone and benzene in the ratio 5 to 1 tended "to gather" at the boiling point 57—58°, led to the investigation of the boiling point curve and of the composition of the vapour phase. The boiling point curve is normal, and at no point is the composition of the vapour identical with that of the liquid, although at the lower part of the curve the composition of the vapour approaches closely to that of the liquid; this explains "the tendency to gather at 57—58°." The known data regarding vapour pressure curves and boiling point curves of mixtures are collected and classified in order to see how far Bancroft's rule is valid. Five mixtures form exceptions to the rule as they have intersecting vapour pressure curves, but normal boiling point curves without maximum or minimum. These are acetone and ethyl alcohol, propyl alcohol and ethyl acetate, benzene and carbon tetrachloride, benzene and ethyl acetate, benzene and isobutyl alcohol. Repetition of observations seems here desirable. Four cases occur in which a minimum boiling point is obtained with non-intersecting vapour pressure curves. L. M. J.

**Molecular Weights of certain Salts in Acetone.** By HARRY C. JONES (*Amer. Chem. J.*, 1902, 27, 16—22).—The rise in the boiling point of acetone when varying quantities of cadmium iodide, ammonium thiocyanate, mercuric chloride, or sodium iodide are dissolved in it has been determined. The molecular weights found for cadmium iodide (366) vary from 448 to 510, and of ammonium thiocyanate (76·2) from 88 to 102, showing that in these cases the molecules are associated. As the solutions possess an appreciable conductivity (Dutoit and Aston, Laszczynski), there must be at the same time a certain amount of dissociation. The molecular weight found for mercuric chloride is almost exactly normal, and the

solution has practically no conductivity (Laszczynski). For sodium iodide (149.9) the molecular weights vary from 133 to 143. The conductivity has not been determined at the dilutions at which the boiling point experiments were carried out.

The author's results are not in agreement with those of Dutoit and Friderich (Abstr., 1899, ii, 350). J. McC.

**Application of Optical Observations to the Study of Diffusion.** By J. THOVERT (*Compt. rend.*, 1901, 133, 1197—1199).—If a horizontal beam of light penetrates into a parallelepiped containing two superposed solutions of the same salt at different concentrations, it is deviated, and from the observation of this deviation at various time intervals the diffusion may be deduced. The results of experiments based on such observations are, however, postponed.

L. M. J.

**Rate of Hydration of Metaphosphoric Acid.** By J. C. BLAKE and F. C. BLAKE (*Amer. Chem. J.*, 1902, 27, 68—74).—The velocity of hydration of metaphosphoric acid was measured by the method described by Duane (Abstr., 1901, ii, 440), which is based on the change of refractive power of the medium in which the reaction takes place. The hydration in a solution containing 4 grams of metaphosphoric acid and 5 c.c. of water is complete in about 4 days at 18.5°. J. McC.

**Conditions of Equilibrium of Deliquescent and Hygroscopic Salts of Copper, Cobalt, and Nickel, with respect to Atmospheric Moisture.** By W. NOEL HARTLEY (*Sci. Trans. Roy. Dublin Soc.*, 1901, [ii], 7, 313—320. Compare Hartley, Abstr., 1901, ii, 53).—The quantity of water attracted by cupric chloride and bromide, cobalt chloride and bromide, nickel bromide and iodide, under varying conditions of temperature and aqueous vapour pressure, was determined at intervals of a few days over a period of six months. The bromides were found to be more deliquescent than the chlorides, and the iodides than the bromides. The most stable liquid hydrates are those of nickel iodide with 23 and 21 mols. of water; then cobalt bromide and nickel bromide with 18 mols., cobalt chloride with 11 mols., cupric bromide with 4 mols., and cupric chloride with 3 mols. The attraction of the salt for water is independent of the molecular mass of the salt; thus cobalt chloride absorbs more water than cupric chloride; cobalt and nickel bromides absorb more water than cupric bromide.

Cobalt iodide was also investigated, but no figures are given because the salt is decomposed by light. It is so deliquescent that in a moist atmosphere it increases in weight more rapidly than sulphuric acid.

J. C. P.

**Catalysis.** By WILHELM OSTWALD (*Zeit. Elektrochem.*, 1901, 7, 995—1004).—Four classes of catalytic actions are distinguished, namely, those in (1) supersaturated systems, (2) homogeneous systems, (3) heterogeneous systems, (4) actions of enzymes. In the first class, a more stable system exists, which differs from the unstable super-

saturated system by containing a new phase. In general, the new phase cannot be formed spontaneously, but the addition of a very minute quantity of it suffices to initiate the change. The substance of which the new phase consists is not necessarily present in the system; dilute solutions of lead salts and thiosulphates, for example, behave as though they were supersaturated with lead sulphide. Owing to the small amount of the catalytic agent required, it can add no energy to the system; the change must therefore be accompanied by a diminution of free energy (not necessarily by a development of heat). This applies equally to all changes taking place under the influence of a catalytic agent, and such changes can only occur in unstable systems. An unstable homogeneous system can only exist in a condition of change, which change may, however, be so slow as to escape recognition. A catalytic agent accelerates or retards the change, without itself forming a constituent of the initial or final products. Apparently all kinds of substances may act as catalysers, and all kinds of reactions may be influenced by them. Liebig's view that catalysis is due to molecular vibrations communicated to the reacting substances by the catalyser, is rejected as being incapable of proof or disproof. The theory of intermediate products is not contradicted by the laws of chemical kinetics, although it has never been proved that the velocities of the partial reactions were greater than that of the direct reaction, and until this is done the theory can only be regarded as a possible explanation. In any case, it cannot explain all catalyses, especially those in which a reaction is retarded. Heterogeneous catalyses, those in presence of platinum, for example, are also probably accelerations of slow reactions, possibly due to condensation of gaseous substances. The action of enzymes is entirely analogous to the action of the simpler catalytic agents. In the animal body, where the temperature is practically constant, and the concentrations of the reacting substances can vary within comparatively narrow limits, the velocities of the different reactions, on the exact balance of which the maintenance of life depends, are regulated by means of enzymes. The study of catalysis from this point of view is of the utmost interest. T. E.

**Dilution Constant of Saline Solutions.** By ALBERT COLSON (*Compt. rend.*, 1901, 133, 1207—1209).—At certain temperatures, dilution of a solution produces no thermal change, and this temperature had been previously found for dilute solutions (25 grams per litre) of sodium chloride. The researches have been extended to saturated solutions about 10 times as concentrated, but the value for the inversion point is the same as that previously found, namely,  $52^{\circ}$ . For strong solutions of potassium chloride, the value obtained was  $64.5^{\circ}$ ; for sodium nitrate  $116^{\circ}$  (by extrapolation), and potassium nitrate about  $122^{\circ}$  (by extrapolation) (compare this vol., ii, 4). L. M. J.

**Saturated Solutions of Salts of Analogous Series.** By CARLO ROSSI (*Gazzetta*, 1901, 31, ii, 502—510).—A comparison of the solubility coefficients of analogous salts shows that the ratio of the molecular weights of two salts is an integral multiple of the ratio between the corresponding solubility coefficients at a certain temperature, the



solubility coefficient being the number of grams of a compound dissolved by 100 grams of water and analogous salts being such as have one ion common whilst the other ions are analogous in the sense of the periodic law. This is shown by the numbers in the following table :

Pairs of salts.	Molecular weights.	Solubility co-efficients.	Ratio between the		Ratio of A to B.	Difference.
			Molecular weights (A).	Solubility co-efficients (B).		
{ BaCl <sub>2</sub> .....	208	35·7	1·318	0·66	2	0·01
{ SrCl <sub>2</sub> .....	158	53·9				
{ BaCl <sub>2</sub> .....	208	35·7	1·87	0·482	4	0·048
{ CaCl <sub>2</sub> .....	111	74·01				
{ SrCl <sub>2</sub> .....	158	53·9	1·42	0·72	2	0·02
{ CaCl <sub>2</sub> .....	111	74·01				
{ BaBr <sub>2</sub> .....	297·32	98·03	1·201	1·117	1	0·034
{ SrBr <sub>2</sub> .....	247·52	87·71				
{ BaBr <sub>2</sub> .....	297·32	98·03	1·417	0·784	2	0·081
{ CaBr <sub>2</sub> .....	199·92	125				
{ SrBr <sub>2</sub> .....	247·52	87·71	1·238	0·701	2	0·168
{ CaBr <sub>2</sub> .....	199·92	125				
{ Ba(NO <sub>3</sub> ) <sub>2</sub> ..	261·4	9·2	1·235	0·1256	10	0·021
{ Sr(NO <sub>3</sub> ) <sub>2</sub> ..	211·6	70·8				
{ KCl .....	74·5	29·2	1·75	0·45	4	0·05
{ LiCl .....	42·47	63·6				
{ KBr .....	119	53·48	1·368	0·373	4	0·124
{ LiBr .....	87	143				
{ KI .....	166	209	1·23	0·43	3	0·06
{ LiI .....	134	476				
{ CoSO <sub>4</sub> ...	155·06	60·4	1·001	1·055	1	0·054
{ NiSO <sub>4</sub> ...	154·76	57·2				

Hence the saturated solutions of analogous salts at one and the same temperature are equal molecular solutions or else there is a simple relation between the numbers of molecules of the different salts dissolved by the same number of water molecules. From the numbers in the above table, it can be calculated that the number of molecules of water required to dissolve 1 mol. of salt are, for barium, strontium, and calcium chloride, 32, 16, and 8 respectively, so that the numbers of molecules of the salts which saturate the same quantity of water stand in the relation of 1 : 2 : 4. Similar relations are exhibited by the other sets of analogous salts given in the table. Further, the ratio between the molecular volumes of a pair of analogous salts is a simple multiple of the ratio between the volumes of the solubility coefficients ; for the alkaline earth chlorides, these relations are shown in the table on p. 200 :

It is readily shown, further, that the molecular volumes of saturated solutions of salts of analogous series have the same values at a definite temperature. Such saturated solutions are regarded by the author as representing, at any definite temperature, true chemical compounds,

	Molecular volumes.	Volume of solubility coefficients.	Ratio of molecular volumes.	Ratio of solubility coefficient volumes.
f BaCl <sub>2</sub> .....	54.2	9.27	1.04	0.52
{ SrCl <sub>2</sub> .....	51.7	17.61		
f BaCl <sub>2</sub> .....	54.2	9.27	1.08	0.27
{ CaCl <sub>2</sub> .....	50.09	33.39		
f SrCl <sub>2</sub> .....	51.7	17.61	1.03	0.52
{ CaCl <sub>2</sub> .....	50.09	33.39		

which are liquid and readily dissociated, being destroyed by the very slightest change in temperature.

T. H. P.

**Theory of the Molecular Constitution of Supersaturated Solutions.** By W. NOEL HARTLEY (*Sci. Proc. Roy. Dublin Soc.*, 1901, 9, 529—542).—In the author's opinion, the hydrate existing in a so-called supersaturated solution is not the same as the hydrate which crystallises out; the phenomenon of supersaturation is a manifestation of a difference in the solubilities of two distinct hydrates at a given temperature. From a study of copper sulphate, cobalt iodide, and cupric bromide, it appears that an anhydrous salt must become hydrated before it can pass into solution. The author finds confirmation of his views in the behaviour of coloured salt solutions, particularly cupric bromide and cobalt chloride. Nicol's work and views (*Abstr.*, 1898, ii, 369) are discussed, and compared with the author's (see also Hartley, *Abstr.*, 1901, ii, 53; Wyrouboff, *ibid.*, 149).

J. C. P.

**Clearing of Turbid Solutions.** By GEORG QUINCKE (*Ann. Phys.*, 1902, [iv], 7, 57—96).—The author's results are summarised as follows. Water, containing in suspension gum mastic, gamboge, shellac, oleic acid, and similar substances, is cleared by the addition of very small quantities of an acid or a salt solution. In the process, the particles unite to form flocks, and settle at the bottom or on the sides of the containing vessel. The flocks consist of drops and bubbles of the substance in the liquid or solid state, and usually enclose more or less air. The formation of flocks and the final clearing of the solution are due to a periodic distribution of small quantities of the clarifying liquid on the surface of the suspended particles; this produces eddies in the surrounding fluid and drives the particles against each other and against the walls of the containing vessel. Both electrolytes and non-electrolytes may act as clarifying agents. The relative velocities of clarification induced by different agents alter with the quantity and nature of the suspended substance. The flocks covered with a layer of clarifying liquid must be nearly isoelectric with the surrounding fluid, and therefore cannot be electrically displaced (compare Hardy, *Proc. Roy. Soc.*, 1900, 66, 111). The flocks may be deposited on either the light or the dark side of a vessel, according to the distribution of the clarifying liquid. The silverising of glass by chemical methods is a particular case of the clarification of a turbid solution.

J. C. P.

**Periodic Classification of the Elements.** By HEINRICH BILTZ (*Ber.*, 1902, 35, 562—568).—To simplify the classification, the author suggests inserting a group of elements in place of a single element, for example, Mn, Fe, Co, Ni, in place of manganese. The groups thus made are  $\Sigma\text{Ce} = \text{La, Ce, Pr, Nd}$ ;  $\Sigma\text{Fe} = \text{MnFe, Co, Ni}$ ;  $\Sigma\text{Pd} = \text{Ru, Rh, Pd}$ ;  $\Sigma\text{Pt} = \text{Os, Ir, Pt}$ . The new atmospheric elements are placed in group 1;  $\Sigma\text{Ce}$  occupies the 7th place in group 4;  $\Sigma\text{Fe}$ ,  $\Sigma\text{Pd}$ , and  $\Sigma\text{Pt}$  positions 3, 5, and 8 in group 8.

He	Li	Be	B	C	N	O	F
Ne	Na	Mg	Al	Si	P	S	Cl
Ar	K	Ca	Sc	Ti	V	Cr	$\Sigma\text{Fe}$
X	Kr	Cu	Zn	Ga	Ge	As	Se
	Rb	Sr	Y	Zr	Nb	Mo	$\Sigma\text{Pd}$
	Ag	Cd	In	Sn	Sb	Te	$\Sigma\text{Pt}$
	Cs	Ba	$\Sigma\text{Ce}$		Ex		
		Hg	Yb		Ta	W	
	Au		Tl	Pb	Bi		
				Th	U		

J. J. S.

**Prout's Hypothesis and the Tendency of Atomic Weights to approach Whole Numbers.** By MAX RUDOLPHI (*Chem. Zeit.*, 1901, 25, 1133—1134).—The deviation of atomic weights from whole numbers is attributed to the presence of small quantities of unknown elements, the properties of which are closely allied to those of the element with which they are respectively mixed (compare Booth, *Chem. News.*, 1901, 83, 262).

K. J. P. O.

**New Construction of Laboratory Hood.** By JOSEF HABERMANN and A. OESTERREICHER (*Zeit. anal. Chem.*, 1901, 40, 767—768).—Instead of the single, comparatively small, circular or square opening by which, in most laboratories, the hood communicates with a chimney, this hood has a number of vertical slits at the back, communicating with a common flue. The consequence is that all parts of the hood are equally ventilated, which is not the case with the usual construction.

M. J. S.

**Simple Condenser.** By JOSEF HABERMANN and A. OESTERREICHER (*Zeit. anal. Chem.*, 1901, 40, 769—770).—The tube in which condensation is to take place has a vertical position. Round it is wrapped a layer of stout, porous paper, which at the upper end is thickened until it fits the neck of a water reservoir made by cutting off the bottom of a bottle. Sufficient water percolates through this plug to keep the paper jacket wet, and the evaporation of the water from the paper is the principal factor in the cooling process. Any excess of water is caught by a funnel near the bottom of the tube and may be returned to the reservoir even if it is warm.

M. J. S.

**Modification of Pepys' Gasholder.** By JOSEF HABERMANN and A. OESTERREICHER (*Zeit. anal. Chem.*, 1901, 40, 771).—The water reservoir of the Pepys' gasholder, being smaller than the gas reservoir, requires to be repeatedly filled up with water while the gas is being used, with the result that the gas is subjected to large and sudden

changes of pressure. This inconvenience is altogether obviated by connecting the water reservoir with a side tube having a constant level overflow, such as is commonly used for supplying water-baths.

M. J. S.

**Chemical Balance with Constant Load.** By A. GAWALOWSKI (*Zeit. anal. Chem.*, 1901, 40, 775—776).—The balance has only one stirrup, which carries two scale pans, one above the other. The counterpoise consists of one or more heavy nuts running on a screw which forms an extension of the opposite arm of the beam. To make a weighing, a weight equal to the maximum load for which the balance is constructed is placed on one of the scale pans and equilibrium is adjusted by means of the nuts. The substance to be weighed is then placed on the second pan and equilibrium is restored by altering the weight on the first pan. The difference between the two weights gives the weight of the substance.

M. J. S.

**Simple Apparatus for Drying under Reduced Pressure at High Temperatures.** By FRITZ PREGL (*Zeit. anal. Chem.*, 1901, 40, 781—785).—A glass tube closed at one end is inserted horizontally into an air-bath and a boat containing the substance is pushed into the tube until it occupies a position close to the thermometer. In the portion of the tube external to the oven is placed a boat containing a desiccating agent (calcium chloride, glass beads moistened with sulphuric acid, or phosphoric oxide). The open end of the tube is then closed by a rubber stopper carrying a stop-cock tube and a small mercury manometer. The tube is exhausted and the oven heated. Since the desiccating agent remains cold (which is an essential condition), it exerts its full power of absorbing water vapour, and even substances which are most difficult to dry, reach a constant weight in three to four hours. After admitting dry air to the tube, the boat containing the substance should at once be enclosed in a weighing tube, since even in a desiccator many substances absorb moisture. To protect the tube from being soiled by the desiccating agent, the boat in which this is contained is enclosed in an outer one of thin sheet brass.

M. J. S.

**Apparatus for Extracting Aqueous Liquids by Chloroform.** By FRITZ PREGL (*Zeit. anal. Chem.*, 1901, 40, 785—787).—A glass tube 22 cm. long and 24 mm. in diameter is narrowed at its lower end and joined to a tube 4 mm. in diameter, which is bent upwards parallel to the wide tube. At 2 cm. from the upper end of the wide tube, a side tube 7 mm. in diameter is fused in and is bent downwards and joined to the 4 mm. tube. At the junction, the 7 mm. tube is bent sideways in a nearly horizontal direction for a distance of 16 cm., and then downwards, and at this point is connected with a flask containing chloroform. Chloroform is also placed in the 24 mm. tube, and is then covered with the aqueous liquid to be extracted; an apparatus of this size is constructed to take 50 c.c. A condenser is fitted to the wide tube and the chloroform in the flask is boiled. The vapour rising through the 7 mm. tube is condensed, drips through the



aqueous liquid, and augments the volume of chloroform at the bottom of the 24 mm. tube until this rises to the point where the 4 mm. tube enters that of 7 mm. ; it then flows over into the flask.

M. J. S.

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## Inorganic Chemistry.

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**Lowering of the Freezing Point of Aqueous Hydrogen Peroxide.** By HARRY C. JONES, JAMES BARNES, and EDWARD P. HYDE (*Amer. Chem. J.*, 1902, 27, 22—31. Compare Calvert, this vol., ii, 10).—The molecular lowering of the freezing point of water and aqueous hydrogen peroxide by potassium chloride, sodium nitrate, or potassium nitrate has been determined, and the results show that the salts produce a greater depression in water than in the aqueous peroxide solution. This indicates that the hydrogen peroxide either decreases the dissociating power of the water or that it acts as a polymerising agent. In the case of the potassium nitrate, the smaller depression in the hydrogen peroxide solution cannot be satisfactorily explained by polymerisation, and it is more probable that combination takes place between the salt and the hydrogen peroxide.

The authors recommend the following method of obtaining a pure solution of hydrogen peroxide. Commercial hydrogen peroxide is treated with excess of zinc oxide, and after some time this is filtered off and the solution distilled slowly from a water-bath under a pressure of 60—90 mm. The last two-thirds of the distillate is concentrated on a water-bath at a temperature not higher than 50°.

J. McC.

**Existence of Higher Hydrogen Peroxides.** By A. BACH (*Ber.*, 1902, 35, 158—160. See Abstr., 1900, ii, 470; 1901, ii, 14).—A reply to Ramsay's criticisms (*Trans.*, 1901, 79, 1326). Supplementing the author's previous reply (*loc. cit.*) to Armstrong's criticisms (*Proc.*, 1900, 16, 134), experiments are also described, in which 10 c.c. of a solution of hydrogen peroxide, when titrated with potassium permanganate, is shown to evolve the same quantity of oxygen whether acidified with sulphuric or acetic acid.

R. H. P.

**Preparation of Chlorine from Permanganates.** By CARL GRAEBE (*Ber.*, 1902, 35, 43—45).—The method of preparing chlorine from solid potassium permanganate is preferable to that in which a concentrated solution of the corresponding calcium salt is employed. When concentrated hydrochloric acid is dropped onto the solid potassium salt, the evolution of gas commences at the ordinary temperature; the mixture is finally heated to complete the decomposition of the permanganate, an excess of the acid (10 mols.) being required for this purpose. In this way, a steady current of chlorine free from oxygen or chlorine dioxide is readily obtained.

G. T. M.

**Action of Carbon Dioxide and Alkali Salts on Metallic Oxides, &c.** By O. SACKUR (*Ber.*, 1902, 35, 94—96).—Kühling concludes from his experiments (this vol., ii, 79) that nitric acid is stronger than hydrochloric acid, an exceptional result in view of the parallelism between the strength of an acid and its conductivity and degree of dissociation. The author points out that Kühling's observations are perfectly in accord with well-known physico-chemical laws. The two points in which mercuric nitrate differs from mercuric chloride are (1) the degree of dissociation in solution, which is very small in the case of the chloride, and (2) the tendency to form complex salts, much more marked in the case of the chloride. This difference in the behaviour of mercuric nitrate and chloride has nothing to do with the relative strength of nitric and hydrochloric acids.

J. C. P.

**Relative Strength of Hydrochloric and Nitric Acids.** By GUIDO BODLÄNDER (*Ber.*, 1902, 35, 99—102. Compare Abstr., 1901, ii, 383).—The author criticises Kühling's conclusions (Abstr., 1901, ii, 656, and this vol., ii, 79) that nitric acid is stronger than hydrochloric acid, and shows that Kühling's experiments on the action of carbon dioxide on solutions of alkali chlorides and nitrates in the presence of insoluble metallic oxides are perfectly explicable on the law of mass action and the ionisation theory.

K. J. P. O.

**The Air of the Sea and of Maritime Pine Forests.** By H. DUPHIL (*Soc. sci. et Stat. Zool. d'Arcachon Univ. Bordeaux, Trav. des Lab.*, 1900—1901, 51—67).—The air in the neighbourhood of Arcachon was analysed chemically and bacteriologically. The presence of excess of ozone, of terebenthene, of sodium chloride, and of iodine, and the paucity of bacteria are the main points.

W. D. H.

**Hydrogen Sulphide Apparatus for Students' Laboratories.** By ALFRED WÖHLK (*Zeit. anal. Chem.*, 1902, 41, 14—17).—The principle of the constant apparatus is made use of, with arrangements for drawing off the exhausted acid, and other details which can only be gathered from the figure.

M. J. S.

**Action of Colloidal Platinum on Persulphuric Acid and its Salts.** By T. SLATER PRICE (*Ber.*, 1902, 35, 291—294).—Colloidal platinum does not decompose solutions of potassium or ammonium persulphate, either when neutral or slightly acid; it is also without action on aqueous persulphuric acid obtained by decomposing a solution of its barium salt with sulphuric acid. The speed of decomposition of hydrogen peroxide by platinum is only slightly increased by the addition of persulphates; free persulphuric acid diminishes it. On the other hand, Caro's acid, after dilution with ice, is rapidly reduced by hydrogen peroxide in presence of platinum, although itself not affected by the metal.

The author discriminates between the formulæ  $\text{H}_2\text{SO}_5^{\cdot}$  (Baeyer and Villiger) and  $\text{H}_2\text{S}_4\text{O}_{14}$  (Lowry and West) for Caro's acid, in the following way. The formation of the acid  $\text{H}_2\text{SO}_5^{\cdot}$ , according to the equations (i)  $\text{K}_2\text{S}_2\text{O}_8 + \text{H}_2\text{SO}_4 = \text{H}_2\text{S}_2\text{O}_8 + \text{K}_2\text{SO}_4$ , (ii)  $\text{H}_2\text{S}_2\text{O}_8 + \text{H}_2\text{O} =$

$\text{H}_2\text{SO}_5 + \text{H}_2\text{SO}_4$ , involves the addition to the solution of 1 mol. of an acid for each mol. of Caro's acid formed; the ratio of the amount of iodine measuring the Caro's acid to the growth of acidity (expressed in grams of  $\text{H}_2\text{SO}_4$ ), should thus be 254 : 98, that is, 2.59. Practically it was found to be 2.56. On the other hand, the equations (i)  $2\text{K}_2\text{S}_2\text{O}_8 + 2\text{H}_2\text{SO}_4 = 2\text{H}_2\text{S}_2\text{O}_8 + 2\text{K}_2\text{SO}_4$  and (ii)  $2\text{H}_2\text{S}_2\text{O}_8 = \text{H}_2\text{S}_4\text{O}_{14} + \text{H}_2\text{O}_2$ , predicate the formation of 1 mol. of hydrogen peroxide per mol. of Caro's acid produced, and a value 245 : 34, or 7.47 for the ratio of iodine liberated to the amount of hydrogen peroxide present. The value found for this ratio varied widely, namely, from 136.0 to 566.7; the lack of coincidence with the theoretical value is held to disprove the formula  $\text{H}_2\text{S}_4\text{O}_{14}$  for Caro's acid.

W. A. D.

**Presence of Tellurium in American Silver Ingots.** By CAMILLE VINCENT (*Bull. Soc. Chim.*, 1902, [iii], 27, 23—24).—The author finds that the brittleness and bad quality of certain American silver ingots is due to the presence of a small quantity of tellurium.

A. F.

**Red Phosphorus.** By RUDOLPH SCHENCK (*Ber.*, 1902, 35, 351—358).—A solution of yellow phosphorus in rectified phosphorus tribromide, when maintained at 170—190°, slowly deposits the red modification, and determinations of the rate of deposition have been made in order to ascertain the nature of the allotropic change. The experiments were carried out in the dark, the solutions being prepared in tubes containing an atmosphere of carbon dioxide. The transformation does not occur in very concentrated solutions, and a concentration of about 1 per cent. was employed.

If red phosphorus is a dimorphous form of the yellow variety, the change would not involve any variation in the number of molecules present and would therefore be unimolecular, having the characteristic differential equation  $-dc/dt = KC$ , where  $C$  is the concentration,  $t$  the time, and  $K$  the transformation velocity constant.

If, however, the red modification is a polymeride of the yellow form, then the reaction is polymolecular and may be represented by the differential equation  $-dC/dt = KC^n$  where  $n$  is the ratio of the molecular complexity of the two allotropes.

The value of  $K$ , found by integrating these equations, would be either  $1/t \log C_0/C$  or  $1/t(n-1)[1/(C^n-1) - 1/(C_0^n-1)]$ , where  $C_0$  is the original concentration. Since red phosphorus is appreciably soluble in phosphorus tribromide, it becomes necessary to modify the preceding expressions by introducing a correction factor  $a$  which represents the amount of the red variety remaining dissolved in the solvent under the conditions of the experiment;  $K$  now becomes either  $1/t(n-1) \log(C_0-a)/(C-a)$  or  $1/t(n-1)[1/(C-a)^{n-1} - 1/(C_0-a)^{n-1}]$ .

The experiments were made at two temperatures, 172° and 184°, and the results, which are tabulated, show that  $K$  is constant only on the assumption that  $n$  is 2, or, in other words, that the reaction is bimolecular.

The addition of a trace of phosphorus tetriodide,  $\text{P}_2\text{I}_4$ , trebles the velocity of transformation without otherwise affecting the character of the change.

The precipitated phosphorus has a bright red colour, and in this

respect corresponds with the variety obtained by Retgers from liquid yellow phosphorus at temperatures below  $250^{\circ}$  and also with that precipitated from the carbon disulphide solution under the influence of light; it is rather more rapidly oxidised than the ordinary dark red commercial product. These differences in colour and chemical behaviour may, however, be due to a finer state of division.

Although the experiments indicate that the initial change is the conversion of  $2P_4$  into  $P_8$ , yet it does not follow that red phosphorus has this molecular complexity; the substance  $P_8$  is probably an extremely labile form rapidly changing into the more highly polymerised final product.

G. T. M.

**Boron Nitride.** By LUDWIG MOESER and W. EIDMANN (*Ber.*, 1902, 35, 535—539).—Boron nitride is best prepared by passing ammonia over a strongly heated and previously fused mixture of boron trioxide and tricalcium phosphate; after washing with dilute hydrochloric acid, an 80—90 per cent. yield of boron nitride is obtained. This is never quite pure, as it is always partially hydrolysed by moist air. When fused with boron nitride, arsenious, antimonious, bismuth, and cadmium oxides are reduced to the metals, with the accompanying formation of borate and nitrous oxide; zinc and ferric oxides are unaltered; molybdenum and chromium trioxides are reduced to lower oxides, and sulphates are reduced to sulphides. A mixture of boron nitride and sodium fluoride, when treated with sulphuric acid, yields ammonium sulphate and boron fluoride. Both sulphur dioxide and carbon dioxide are partially reduced when heated with boron nitride. When melted with sodium peroxide, the nitride yields the nitrate and borate.

R. H. P.

**Use of Potassium Percarbonate as a Substitute for Hydrogen Peroxide.** By FREDERICK P. TREADWELL (*Chem. Zeit.*, 1901, 25, 1008).—Potassium percarbonate is now prepared on the large scale in a high degree of purity, and when in the dry state can be kept without undergoing decomposition. With cold dilute acids, it yields a solution of hydrogen peroxide. It can also be used instead of an alkaline solution of hydrogen dioxide. Thus hydrogen sulphide and soluble sulphides are oxidised to sulphuric acid; manganous, nickel, and cobalt salts to higher oxides, and chromic salts to chromates. Hypochlorites and hypoiodites are reduced to chlorides and iodides.

K. J. P. O.

**Preparation and Properties of Sodium Hydride.** By HENRI MOISSAN (*Compt. rend.*, 1902, 134, 71—75).—Sodium hydride,  $NaH$ , is obtained by heating sodium in hydrogen at  $370^{\circ}$ . The regulation of the temperature is important, and the upper part of the tube must be at a slightly lower temperature. It forms white crystals readily decomposed by even a trace of moisture, and taking fire spontaneously if exposed to moist air. When heated in a vacuum, it dissociates at a temperature below the softening point of glass. Its sp. gr. is about 0.92, and it is insoluble in terebenthene, carbon tetrachloride, carbon disulphide, or benzene; it dissolves in fused sodium, and



sodium amalgam, but not in liquefied ammonia. It burns brilliantly in fluorine, or chlorine, or nitrogen peroxide, but not in bromine vapour unless heated; in iodine vapour it ignites at about  $100^{\circ}$ . It also burns when heated in air or oxygen, is decomposed by acids, and, with great energy, by solid oxidising agents. When gently heated in carbon dioxide, it liberates carbon.

C. H. B.

**Solubilities of Mixtures of Sodium Sulphate and Sodium Chloride.** By ATHERTON SEIDELL [with FRANK K. CAMERON] (*Amer. Chem. J.*, 1902, 27, 52—62).—The solubilities of various mixtures of these two salts have been determined at temperatures ranging from  $10^{\circ}$  to  $35^{\circ}$ , and the results are graphically represented by curves. The curves representing the respective quantities of the two salts at  $33^{\circ}$  and higher temperatures consist of two parts with a decided break at a point corresponding with nearly 10 grams of sulphate and about 32 grams of chloride per 100 grams of water. The curves obtained for lower temperatures consist of three parts with two decided breaks. As the quantity of sulphate increases, the first break occurs at practically the same point as that obtained above  $33^{\circ}$ , and the middle part runs parallel with the curve for higher temperatures; then there is a break, and the last part of the curve, representing the solubility of the sulphate in solutions of the chloride of increasing concentration, has a minimum point. The explanation is that above  $33^{\circ}$  the sodium sulphate is anhydrous; below this temperature, the decahydrate is transformed into anhydrous salt in presence of sodium chloride, and therefore the middle part of the curves represent the condition when the solid phase is the anhydrous sulphate. It has been experimentally proved that the transition point of sodium sulphate ( $33^{\circ}$ ) is lowered by the addition of sodium chloride.

J. McC.

**Action of Hydrogen Peroxide on Silver Oxide.** By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1902, [vii], 25, 78—97).—A detailed account of work already published (compare Abstr., 1901, ii, 383, and this vol., ii, 18).

G. T. M.

**Solubility of Gypsum in Aqueous Solutions of certain Electrolytes.** By FRANK K. CAMERON and ATHERTON SEIDELL (*J. Physical Chem.*, 1901, 5, 643—655).—An extension of the previous work on the solubility of gypsum in sodium chloride solutions (this vol., ii, 75). In magnesium chloride solutions, a maximum solubility was obtained, the concentration of gypsum at this point being about four times that of a saturated aqueous solution. The maximum occurs at about the same chlorine concentration as in the case of sodium chloride solutions. In solutions of calcium chloride, the solubility of gypsum decreases as the concentration of calcium chloride increases, at first rapidly, then slowly. Sodium sulphate causes a decrease of solubility until this attains a concentration of about 17.5 grams per litre, after which it causes an increase. The solubility in sodium chloride solutions, when calcium carbonate was also present in the solid phase, was also investigated; it was found that the presence of the carbonate has

but little effect until the concentration of the sodium chloride reaches about 80 grams per litre, when a sharp, abrupt change of the solubility curve occurs, and the solubility rapidly falls. The author considers the results support the view that ionic complexes are formed in solutions of high concentrations. L. M. J.

**Solubility of Calcium Hydrogen Phosphate in Water.** By ARTHUR RINDELL (*Compt. rend.*, 1902, 134, 112—114).—Experiments in which different proportions of calcium hydrogen phosphate were agitated in water for times varying from 12 to 252 hours, confirm the author's earlier conclusion that when this salt dissolves in water decomposition takes place, and show that a very considerable time is necessary to establish equilibrium. With quantities of the salt less than 10 grams per litre, saturation is not attained, even after 252 hours. The ratio  $\text{H}_3\text{PO}_4 : \text{CaO}$  has a lower value the less complete the saturation. C. H. B.

**Preparation and Properties of Strontium Hydride.** By HENRI GAUTIER (*Compt. rend.*, 1902, 134, 100—103).—Strontium hydride,  $\text{SrH}_2$ , is obtained by the action of hydrogen, at an incipient red heat, on the alloy of cadmium and strontium containing 45 per cent. of the latter (this vol., ii, 138). It is a white solid which very readily decomposes water with liberation of hydrogen and development of a large quantity of heat. It is not attacked by chlorine or bromine in the cold, but burns when gently heated in chlorine, and at a dull red heat in bromine vapour. When heated with iodine or sulphur, it is decomposed, and it is violently oxidised when heated with solid oxidising agents. It burns slowly at a red heat in dry air, and more energetically in oxygen. C. H. B.

**Radioactive Lead.** By FRITZ GIESEL (*Ber.*, 1902, 35, 102—105. Compare Abstr., 1901, ii, 99; this vol., ii, 78).—A specimen of radioactive lead which had retained its activity for a year (*loc. cit.*) has been spectroscopically examined by Demarçay, who finds that in addition to lead (the chief constituent), there are present iron, magnesium, calcium, barium, strontium, chromium, aluminium, manganese, bismuth, and tin, possibly also molybdenum and yttrium. The radium lines are entirely absent, but there are two lines ( $\lambda 3659\cdot6$  and  $\lambda 4116\cdot8$ ) unaccounted for by any of the elements enumerated, and these, along with the radioactivity, might be attributed to some hypothetical substance. It is possible also to regard the radioactivity in question as simply induced in lead by radium; this point is to be further investigated. The author criticises the work and claims of Hofmann and Strauss (Abstr., 1901, ii, 655; this vol., ii, 78). J. C. P.

**Combination of Sulphates with Hydrogen Chloride.** By CHARLES BASKERVILLE (*J. Amer. Chem. Soc.*, 1901, 23, 894—897) [with LIONEL WEIL].—Mercuric sulphate was treated with strong hydrochloric acid, the mixture evaporated to dryness, and the residue sublimed at  $240^\circ$ ; after washing the sublimate with alcohol and ether, a residue was obtained of a substance,  $\text{HgSO}_4\cdot\text{HCl}$ , which is not affected

by hydrochloric acid and was only slightly soluble in nitric acid. By heating mercuric sulphate in a stream of dry hydrogen chloride, the compound  $\text{HgSO}_4 \cdot 2\text{HCl}$ , described by Ditte (Abstr., 1879, 299; 1880, 12), is obtained. When mercuric chloride is heated with monohydrated sulphuric acid, the compound  $\text{HgSO}_4 \cdot 2\text{HCl} \cdot \text{H}_2\text{O}$  is produced, which sublimes in monoclinic crystals.

[With ISAAC F. HARRIS].—When cadmium sulphate,  $3\text{CdSO}_4 \cdot 8\text{H}_2\text{O}$ , is heated at  $150^\circ$ , it loses 4 mols. of water; if it is treated with dry hydrogen chloride at the same temperature, the compound  $3\text{CdSO}_4 \cdot 4\text{H}_2\text{O} \cdot 4\text{HCl}$  is produced, whilst at  $200^\circ$  the compound  $3\text{CdSO}_4 \cdot 8\text{HCl}$  is formed, which on prolonged heating at this temperature or at a dull red heat for a shorter period is converted into cadmium chloride; these new compounds are very deliquescent. E. G.

**Mutual Action of Alumina and Ferric Oxide at Incipient White Heat.** By H. WARTH (*Chem. News*, 1901, 84, 305–306).—When mixtures of alumina and ferric oxide are heated before the blow-pipe, they become pure white in colour provided the proportion of the ferric oxide does not exceed 7 per cent.; beyond that stage, the mixtures are brown after they have been heated. D. A. L.

**Chemical Equilibrium of Carbon-Iron Systems.** By GEORGES CHARPY and LOUIS GRENET (*Compt. rend.*, 1902, 134, 103–105).—The separation of graphite from cast iron is materially influenced by the proportion of silicon, and it is probably neglect of this point which has led to the contradictory results of previous observers. Observations on the behaviour of iron containing different proportions of silicon heated at different temperatures in various ways lead to the following conclusions: the separation of graphite during reheating begins at a lower temperature the higher the proportion of silicon, and when once started will continue at a lower temperature than that at which it begins. At constant temperature, the separation of graphite proceeds progressively at a rate which is lower the lower the temperature and the smaller the proportion of silicon. The proportion of graphite which corresponds with equilibrium is largely independent of the proportion of silicon, but increases as the temperature is lower, so that at low temperatures equilibrium corresponds with the disappearance of all combined carbon; the stable state in the cold coincides with the coexistence of two phases, graphite and pure iron, all the other forms in steel and iron being metastable at a low temperature. C. H. B.

**Oxidation of Ferrous Solutions by Free Oxygen.** By J. W. MCBAIN (*J. Physical Chem.*, 1901, 5, 623–638).—Solutions of ferrous salts containing also a known amount of dissolved oxygen were examined after varying time intervals, and the quantity of ferric salt estimated, a colorimetric method being employed. The oxidation was found to be exceedingly slow, but the rate was proportional to the concentration of the oxygen. In ferrous sulphate, the rate of oxidation was approximately proportional to the square of its concentration, but to the cube of the concentration in the case of ferrous acetate, and to the concentration itself in the case of ferrous chloride.

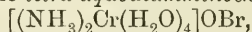
Free acid has a slight retarding effect in the case of the sulphate and acetate, but causes an acceleration in the case of the chloride. The effect of temperature was not fully investigated, but the rate appears to be increased between three- and four-fold for a rise of  $15^{\circ}$ .

L. M. J.

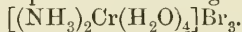
**Action of Potassium Ferricyanide and Soluble Chlorates on Chromium Salts.** By G. SAGET (*Chem. Centr.*, 1902, i, 97; from *Mon. sci.*, 1901, [iv], 15, ii, 764).—Chromium chlorate decomposes on boiling its aqueous solution, chromium trioxide being formed. The addition of potassium ferricyanide facilitates the decomposition. When an aqueous solution of potassium ferricyanide (1 mol.), sodium chlorate (1 mol.), and chromium sulphate (1 mol.) is boiled for an hour, Prussian blue is precipitated, whilst the solution contains chromium trioxide, chlorides, excess of ferricyanide, and a ferric salt; similar reactions take place with other proportions of the salts. Colloidal chromium sesquioxide is also oxidised to chromium trioxide by prolonged boiling with a solution of potassium ferricyanide and sodium chlorate.

E. W. W.

**Tetra-aquodiammino- and Diacidodiaquodiammino-chromium Salts.** By ALFRED WERNER and J. KLIEN (*Ber.*, 1902, 35, 277—291).—Reinecke's salt,  $[(\text{NH}_3)_2\text{Cr}(\text{SCN})_4]\text{NH}_4$ , is oxidised by bromine with complete elimination of the four thiocyno-groups, the latter being thus shown to be combined to the chromium atom through sulphur; the green product is purified by repeatedly precipitating its aqueous solutions with hydrobromic acid, and consists of *dibromodiaquodiamminochromic bromide*,  $[(\text{NH}_3)_2\text{CrBr}_2(\text{H}_2\text{O})_2]\text{Br}$ . The oxidation of  $\alpha$ -trithiocyanodiaquodiamminochromium with bromine yields the same substance, whilst the oxidation of Reinecke's salt with chlorine gives an analogous *chloride*, the product being purified with difficulty. On gradually adding ammonia, or better, pyridine, to an aqueous solution of the bromide, the basic *tetra-aquodiamminochromic bromide*,



is precipitated as a coarsely crystalline, lilac-grey powder; the latter is converted by concentrated hydrobromic acid at  $0^{\circ}$  into a bluish-red, hygroscopic, crystalline powder consisting of the normal salt,



*Tetra-aquodiamminochromic chloride*,  $[(\text{NH}_3)_2\text{Cr}(\text{H}_2\text{O})_4]\text{Cl}_3$ , obtained by the action of hydrochloric acid on the basic bromide at  $0^{\circ}$ , is a bluish-pink, crystalline powder, which crystallises from an aqueous solution, concentrated over phosphoric oxide, in bright red, monoclinic prisms; with ammonia, it yields basic *tetra-aquodiamminochromic chloride*,  $[(\text{NH}_3)_2\text{Cr}(\text{H}_2\text{O})_4]\text{OCl}$ , as a bright reddish-violet, crystalline precipitate.

*Tetra-aquodiamminochromic sulphate*,  $[(\text{NH}_3)_2\text{Cr}(\text{H}_2\text{O})_4]_2(\text{SO}_4)_3$ , obtained by adding sulphuric acid to a strongly alcoholic aqueous solution of the basic bromide, forms reddish-violet, hygroscopic leaflets; the basic *sulphate*,  $[(\text{NH}_3)_2\text{Cr}(\text{H}_2\text{O})_4](\text{SO}_4)(\text{OH})$ , formed by the careful addition of ammonia or pyridine, crystallises in slender, red needles and is insoluble in water.

*Tetra-aquodiamminochromic hydroxide*,  $[(\text{NH}_3)_2\text{Cr}(\text{OH})_2](\text{OH})_3 \cdot \text{H}_2\text{O}$ ,



obtained from the sulphate by the addition of an excess of ammonia or pyridine, is a violet, crystalline powder.

*Dichlorodiaquodiamminochromium chloride*,  $[(\text{NH}_3)_2\text{CrCl}_2(\text{H}_2\text{O})_2]\text{Cl}$ , is gradually formed when tetra-aquodiamminochromic chloride is kept for some months; it can be purified by precipitating its aqueous solution with concentrated hydrochloric acid, forms bright green leaflets, and contains only one-third of its chlorine in a directly ionisable condition. *Dibromodiaquodiamminochromium bromide* resembles it in all respects.

W. A. D.

**Radioactive Thorium.** By KARL A. HOFMANN and F. ZERBAN (*Ber.*, 1902, 35, 531—533).—The thorium preparations previously described (*Abstr.*, 1901, ii, 19) have lost their radioactivity. The radioactivity of preparations from bröggerite, cleveite, samarskite, &c., can be increased by fractional precipitation with concentrated solutions of potassium sulphate and chromate, hydrogen peroxide, and sodium thio-sulphate, the first portions of the precipitate being the most active, whilst ammonium carbonate precipitates the least active portions. Some thoria prepared from uranium-free monazite was inactive, but this and the older preparations became radioactive after contact for a few days with radioactive uranous oxide. Similar results have been observed by Becquerel (this vol., ii, 117) with radioactive barium.

R. H. P.

## Mineralogical Chemistry.

**Geocronite from Val di Castello, Tuscany.** By GIOVANNI D'ACHIARDI (*Zeit. Kryst. Min.*, 1902, 35, 516—519; from *Atti Soc. Toscana Sci. Nat.*, 1901, Mem., 18, 1—16).—The following mean of four analyses made on material from the same crystal of geocronite gives the formula  $\text{Pb}_5\text{AsSbS}_8$ .

Pb.	As.	Sb.	S.	Total.
70.02	4.47	7.78	17.57	99.84

The results of the crystallographic examination show that geocronite is isomorphous with stephanite ( $\text{Ag}_5\text{SbS}_4$ ); the crystals are twinned, and also possibly hemimorphic, like stephanite:

Geocronite,  $a:b:c = 0.6145:1:0.6797$

Stephanite,  $a:b:c = 0.6291:1:0.6851$

A crystallographic relation also exists between geocronite and jordanite ( $\text{Pb}_4\text{As}_2\text{S}_7$ ).

L. J. S.

**Barytes from the Province Caserta.** By PASQUALE FRANCO (*Zeit. Kryst. Min.*, 1902, 35, 523; *Boll. Soc. Geol. Ital.*, 1900, 19, cxxviii—cxxxi).—Optical determinations are given of crystals of

colourless, transparent barytes from druses in limestone. Analysis gave:

SO <sub>3</sub> .	BaO.	SrO.	CaO.	Total.	Sp. gr.
34.66	63.33	2.04	trace	100.03	4.333

L. J. S.

**Solubility of certain Natural Silicates in Water.** By GEORGE STEIGER (*Bull. U.S. Geol. Survey*, 1900, No. 167, 159—160).—The experiments of F. W. Clarke on the alkaline reaction of natural silicates (*Abstr.*, 1900, ii, 109) were only qualitative in character: the following quantitative determinations are now made. Half a gram of each of the finely powdered minerals was placed in 50 c.c. of water at about 70° and shaken from time to time. At the end of a month, the filtered solutions were titrated with hydrochloric acid, methyl-orange being used as an indicator. Below are given the percentages of alkalis in each of the minerals, and (in brackets) the percentages of alkalis, calculated as soda, extracted by the water.

Pectolite, 9.11 (0.57); muscovite, 10.00 (0.32); natrolite, 15.79 (0.30); lintonite, 5.92 (0.29); phlogopite, 9.32 (0.22); laumontite, 1.00 (0.18); lepidolite, 13.00 (0.18); elaeolite, 21.17 (0.16); heulandite, 2.00 (0.13); orthoclase, 16.00 (0.11); analcite, 14.00 (0.10); oligoclase, 9.18 (0.09); albite, 12.10 (0.07); wernerite, 11.09 (0.07); leucite, 21.39 (0.06); stilbite, 1.00 (0.05); chabazite, 7.10 (0.05). L. J. S.

**Action of Water on Natural Meta-silicates.** By FAUSTO SESTINI (*Zeit. Kryst. Min.*, 1902, 35, 511—512; from *Atti Soc. Toscana Sci. Nat.*, 1900, *Proc.-Verb.*, 12, 127—136. Compare preceding abstract).—Distilled water, after remaining in contact with augite for 12—24 hours, acquires a strong alkaline reaction. Augite crystals (280 grams) from Vesuvius, in fragments 1—2 mm. in diameter, were shaken for fifty hours with 750 c.c. of distilled water in a litre flask; there resulted 3.52 grams of a fine powder and 0.161 gram of soluble material, the latter having the composition given under I. When the experiment was repeated in the presence of carbon dioxide, there resulted 3.35 grams of fine powder and 0.2668 gram of soluble material (anal. II). In the second case, the amount of alkalis (Na<sub>2</sub>O and K<sub>2</sub>O) and sulphuric acid is considerably greater than in the first. Blank experiments, however, point to the possibility that some of the dissolved substance is derived from the glass vessels. The fine powder consists of minute fragments of augite and of a white substance soluble in hydrochloric and sulphuric acids, in which the ratio of Al<sub>2</sub>O<sub>3</sub>:Fe<sub>2</sub>O<sub>3</sub> is greater than in the original augite. It follows that augite is decomposed by water at the ordinary temperature with the production of an insoluble aluminium silicate and a soluble portion consisting mainly of an ortho-silicate of calcium, magnesium and ferrous iron; these substances are in turn decomposed by carbon dioxide and oxygen into carbonates, ferric oxide and flocculent silica.

	SiO <sub>2</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	CaO.	MgO.	Cl, SO <sub>3</sub> , Alkalis, CO <sub>2</sub> .
I.	0.0243	0.0043	0.0271	0.0140	gram traces
II.	0.033	0.0195	0.0246	0.036	„
III.	0.007	0.0018	0.0146	0.0058	—
IV.	0.0068	0.0014	0.0194	0.0160	traces

Diopside (20 grams), treated in the same way in 2 litres of water for 50 hours at  $105^{\circ}$ , yielded 0.0476 gram of soluble substance of which the composition is given under III. Tremolite, in the same amount and under the same conditions ( $105^{\circ}$ ), gave 0.0920 gram of soluble matter (anal. IV). Hornblende, asbestos, and diallage also give an alkaline reaction with water. L. J. S.

**Mineralogical Notes.** By ARTHUR S. EAKLE, with analyses by W. T. SCHALLER (*Bull. Dept. Geol. Univ. California*, 1901, 2, 315—325).—Pectolite and datolite occur, together with other secondary minerals, as veins in a rock associated with serpentine near San Francisco. The snow-white, fibrous pectolite gave analysis I; the clear, colourless crystals of datolite gave II.

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	B <sub>2</sub> O <sub>3</sub> .	CaO.	Na <sub>2</sub> O.	H <sub>2</sub> O (ignition).	Total.
I.	53.40	3.87		—	30.56	7.61	4.46	99.90
II.	36.71	0.17	—	22.11	33.83	—	6.52	99.34

*Esmeraldaite* is the name given to a new hydrous sesquioxide of iron from Esmeralda Co., Nevada. It occurs in earthy limonite as pod-shaped masses of a coal-black colour and with a bright, vitreous lustre. It is glassy, and on the edges translucent with a yellowish-red colour by transmitted light. The streak is yellowish-brown. The mineral is very brittle: H,  $2\frac{1}{2}$ ; sp. gr. 2.578. The mean (III) of several analyses gives, after deducting impurities, the formula  $\text{Fe}_2\text{O}_3 \cdot 4\text{H}_2\text{O}$ .

	H <sub>2</sub> O (at $110^{\circ}$ ).	H <sub>2</sub> O (ignition).	Fe <sub>2</sub> O <sub>3</sub> .	Al <sub>2</sub> O <sub>3</sub> .	SiO <sub>2</sub> .	CaO.	P <sub>2</sub> O <sub>5</sub> .	Organic matter.	Total.
III.	15.94	10.24	56.14	5.77	2.05	3.35	4.49	1.37	99.35
IV.	23.72	13.71	12.99	7.44	0.21	—	—	—	

	SO <sub>3</sub> .	FeO.	Na <sub>2</sub> O.	MgO.	
IV.	38.04	0.13	1.68	1.09	99.04

Analysis IV is of a compact, green ferric sulphate, which was taken in a wet, mushy condition from the Redington mercury mine at Knoxville, California. This composition, agreeing with the formula  $\text{Fe}_2(\text{SO}_4)_3 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 27\text{H}_2\text{O}$ , suggests coquimbite, in which the iron is partly replaced by aluminium, and in which there is some occluded water, or the substance may be a mixture of coquimbite [ $\text{Fe}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$ ] and alunogen [ $\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$ ].

Crystals of altaite, with the forms {111}, {100}, and {322}, are intimately associated with gold at Sawmill Flat, Tuolumne Co., California; analysis of the crystals gave:

Te.	Pb.	Ag.	Au.	Fe, Se, S.
32.5	65	trace—0.1	nil	traces

Crystals of gold associated with the altaite contain 91.2 to 94.2 per cent. Au. L. J. S.

**Anorthite from S. Martino, Viterbo.** By FERRUCCIO ZAMBONINI (*Zeit. Kryst. Min.*, 1902, 35, 523; from *Rivista Min. Crist.*, 1900, 24, 4—13).—A crystallographic description is given of crystals of anorthite,

which, with augite, constitute the material of an ejected volcanic block. Analysis gave :

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	MnO.	CaO.	MgO.	Na <sub>2</sub> O.	Insol.	Total.	Sp. gr.
46.25	34.62	1.20	trace	17.16	0.50	0.95	0.12	100.80	2.78

L. J. S.

**Eclogites of the Aiguilles Rouges.** By ÉTIENNE JOUKOWSKY (*Compt. rend.*, 1901, 133, 1312—1313).—The following analyses are given of minerals isolated from an eclogite in the Mont Blanc district. I, pyroxene; II, uralitic hornblende; III, garnet.

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	Total.
I. 51.28	18.11		—	19.17	11.93	100.49
II. 41.24	22.10		13.06	12.08	10.31	98.79
III. 37.37	21.52	—	28.32	7.85	5.57	100.43

Some of the hornblende has been produced by the uralitisation of the pyroxene, but that in the kelyphite has been derived by the alteration of garnet.

L. J. S.

**Analyses of Jadeite Axes.** By F. BERWERTH (*Tsch. Min. Mitth.*, 1901, 20, 357—358).—I, jadeite axe found in Hungary; II, in Upper Austria :

	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	CaO.	MgO.	Na <sub>2</sub> O.	K <sub>2</sub> O.	SiO <sub>2</sub> .	Total.
I.	22.80	1.83	3.71	trace	15.60	—	(55.48)	100.00
II.	22.76	1.83	1.37	0.95	12.07	1.08	(58.94)	100.00

L. J. S.

**Presence of Jadeite Rocks in the Western Alps and in Liguria.** By S. FRANCHI (*Zeit. Kryst. Min.*, 1902, 35, 521—522; from *Boll. R. Com. Geol. Ital.*, 1900, 31, 119—158; *Atti. R. Accad. Lincei*, 1900, 9, [i], 349—354. Compare Abstr., 1898, ii, 525; 1900, ii, 487).—The author records beyond doubt the occurrence *in situ* of jadeite rocks in the Piedmontese and Ligurian Alps, and establishes the identity of these with the material of the neolithic implements found in the same region, a point before only suggested but not definitely proved. Analysis I is of chloromelanite from Mocchie in the Susa valley, and II of jadeite from Prato Fiorito near Monoiso. The former, sp. gr. 3.33, consists mainly of fibres of pale bluish-green pyroxene, partly altered to smaragdite, and with small amounts of garnet, ilmenite, rutile and pyrites; the latter consists of pyroxene with only very little rutile.

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	Na <sub>2</sub> O.
I. 56.85		8.42	9.82	1.12	12.16	4.57	6.91
II. 56.63		17.33	1.74	0.22	13.35	4.36	6.80

	K <sub>2</sub> O.	MnO.	Cr <sub>2</sub> O <sub>3</sub> .	Loss on ignition.	Total.
I. 0.28		trace	—	0.59	100.72
II. —		—	trace	0.10	100.53

L. J. S.



## Physiological Chemistry.

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**The Respiratory Value of Coelomic Fluid in certain Invertebrates.** By L. CUÉNOT (*Soc. Sci. et Stat. Zool. d'Arcachon Univ. Bordeaux Trav. des Lab.*, 1900—1901, 107—125).—By respiratory value is meant the amount of oxygen which can be obtained from each 100 c.c. of blood or fluid from the body-cavity. In those animals which possess no respiratory pigment, the amount of oxygen is small, in fact the same as in the surrounding water. In those possessing respiratory pigments (hæmocyannin, hæmerythrin, &c.), the value is, as would be anticipated, higher. Analytical details are given.

W. D. H.

**The Blood of the Hippocampus.** By J. SABRAZÈS and L. MURATET (*Soc. Sci. et Stat. Zool. d'Arcachon Univ. Bordeaux Trav. des Lab.*, 1900—1901, 74—80).—The paper is mainly histological. The principal point of interest is the phagocytic action of the leucocytes, which are of the lymphocyte and large mononuclear varieties. Granular leucocytes are absent from the blood of this fish.

W. D. H.

**Coagulation of the Blood of Fishes.** By M. E. RODIER (*Soc. Sci. et Stat. Zool. d'Arcachon Univ. Bordeaux Trav. des Lab.*, 1900—1901, 129—132).—Delezenne has shown that fishes' blood is very slow in coagulating spontaneously, but the phenomenon can be hastened by contact with the tissues. These facts are confirmed in the case of various bony and cartilaginous fishes, and it is also shown that the buccal mucus, and peritoneal fluid of these animals are much more active than pieces of muscular and other tissues in hastening coagulation.

W. D. H.

**Glycolysis in Drawn Blood.** By FREDERICK W. PAVY and R. L. SIAU (*J. Physiol.*, 1902, 27, 451—456).—The loss of sugar which occurs in dog's blood during the first two hours after removal is so insignificant as to be of no physiological importance. This is opposed to Lépine's views, but agrees with those of most other workers on the subject. When the time of exposure is longer (4 to 6 hours), there is a definite but never large loss. It is part of Lépine's doctrine that the larger the amount of sugar present, the larger is the loss. This receives no support from the present experiments, and, as a consequence, the percentage loss will be influenced by the amount of sugar which happens to be present. Lépine's *pouvoir glycolytique* which represents the percentage loss can therefore be made to vary at will.

W. D. H.

**Carbon Monoxide in the Blood. Dissociation of Carboxy-hæmoglobin during Life.** By MAURICE NICLOUX (*Compt. rend. Soc. Biol.*, 1901, 53, 953—955, 955—956. Compare Abstr., 1901, ii, 518, 608).—Previous observations have left it uncertain whether the carbon monoxide of the blood comes from the air, or is produced by

the animal. A few experiments are now recorded which show that the amount of gas in the blood of dogs is doubled in quantity when they live in Paris a few days after having been in the country. The author declines to draw definite conclusions at present.

The hypothesis that a living membrane like the placenta can effect the dissociation of carboxyhæmoglobin, is confirmed by observations on fish. Their blood contains the gas when they are kept in water containing carboxyhæmoglobin, the gill membrane here effecting the dissociation.

W. D. H.

**Calorific and Nutritive Value of Food-stuffs.** By JOHANNES FRENTZEL and NASUJIRO TORIYAMA (*Chem. Centr.*, 1901, ii, 1356; from *Arch. Anat. Physiol. (Physiol. Abth.)*, 1901, 551).—A dog was fed on fat and carbohydrate, and then on the same diet with the addition of meat extract. The calorific value of the excretions rose during the latter period. About 63·5 per cent. of the extract was utilised in the organism.

W. D. H.

**Utilisation of Sugars by the Organism.** By CHARRIN and BROCARD (*Compt. rend.*, 1902, 134, 48—50).—Observations on the appearance of sugar in the urine after ingestion in the stomach lead to the conclusion that from the point of view of utilisation by the economy, lævulose is first, then galactose, and finally dextrose.

W. D. H.

**Digestibility of Food in the Stomach.** By CLAUDIO FERMI (*Chem. Centr.*, 1901, ii, 1355; from *Arch. Anat. Physiol. (Physiol. Abth.)*, 1901, *Suppl. Bd.*, 1—83).—The digestibility of various foods was tested by examining the stomach-contents in animals and men after their ingestion. From these observations and others in which artificial digestion was employed, tables of relative digestibility in the stomach are compiled. In dogs, no salivary digestion goes on in the stomach; this is attributed to want of ptyalin in the dog's saliva. In the same animals, feeding on fat inhibits the formation of hydrochloric acid. The addition of pepsin to a diet of flesh has no influence on digestion.

W. D. H.

**Toxic Substance produced by Gastric Digestion.** By E. CASSART and G. SAUX (*Compt. rend. Soc. Biol.*, 1901, 53, 1072—1074).—A living animal into the circulation of which an artificial gastric digestion of meat is injected dies in convulsions. The toxic material was not identified chemically, but is believed to be identical with that which Brieger termed peptotoxin, and subsequent observers have regarded as an artifact.

The authors consider that such observations can be applied to natural digestion, and will explain such pathological processes as tetany.

W. D. H.

**Bile and Digestion of Proteids.** By SIEGFRIED ROSENBERG (*Chem. Centr.*, 1901, ii, 1355—1356; from *Arch. Anat. Physiol. (Physiol. Abth.)*, 1901, 528—531).—Although bile favours the action of trypsin, Röhmann and

Voit found that with moderate meals of flesh, proteid digestion in the intestine is not impaired by the absence of bile. The same result is noticed when very large amounts of flesh are given. W. D. H.

**The Relation of Lipase to Fat Metabolism.** By A. S. LOEVENHART (*Amer. J. Physiol.*, 1902, 6, 331—360).—The reversible action of lipase will explain fat absorption. Lipase is found in considerable quantities wherever fat synthesis is occurring in the body. 'Lipogenesis' is compared with 'glycogenesis,' its two phases being brought about by the same enzyme, which may be fat-forming or fat-splitting, according to conditions. The fatty changes occurring in phosphorus poisoning are not due to changes in the distribution and amount of lipase in the tissues. W. D. H.

**Lipase in the Lower Animals.** By J. SELLIER (*Soc. Sci. et. Stat. Zool. d'Arcachon Univ. Bordeaux Trav. des Lab.*, 1900—1901, 99—106).—Lipase exists in the blood of the principal types of fishes and of invertebrates. Its activity varies a good deal, even in individuals of the same species. The greatest activity among fishes was found in the conger, the least in the selachians. In invertebrates, lipasic activity does not vary with complexity of organisation, thus it is greater in the worm *Sipunculus* than in the cephalopods. W. D. H.

**The Iron of Lymphatic Glands.** By A. GUILLEMONAT and GABRIEL DELAMARE (*Compt. rend. Soc. Biol.*, 1901, 53, 897—899).—The amount of iron in various lymphatic glands from different animals varies from mere traces to 0.38 per 1000. In inanition, it diminishes; after splenectomy, it increases. These facts point to a hæmopoietic function in lymphatic glands, which is confirmatory of the observations of histologists. W. D. H.

**Adrenalin: the Active Principle of the Suprarenal Glands and its mode of Preparation.** By JOKICHI TAKAMINE (*Amer. J. Pharm.*, 1901, 73, 523—531; *Proc. Physiol. Soc.*, 1901, xxix—xxx).—Adrenalin,  $C_{10}H_{15}O_3N$ , the active principle of the suprarenal glands is isolated, according to the condition of the solutions from which it is crystallised, in the form of prisms, slender needles, rhombic plates, boat or leafed-shaped or nodular crystals. An aqueous solution of adrenalin has an alkaline reaction and rapidly absorbs oxygen from the air, the solution becoming pink, then red, and finally brown in colour. Ferric chloride colours the solution emerald green, whilst iodine imparts a vivid pink. On fusion with potassium hydroxide, two crystalline substances were obtained, probably protocatechuic acid and catechol.

Adrenalin is the strongest hæmostatic agent known and an intravenous injection produces an enormous rise of blood pressure.

H. R. LE S.

**Formation of Sugar in Boiled Liver.** By FREDERICK W. PAVY and R. L. SIAU (*J. Physiol.*, 1902, 27, 457—458). No sugar is formed in liver substance if it is kept sterile after it is subjected to thorough

boiling. This conclusion harmonises with what general knowledge would suggest, and the experiments were only rendered necessary because persistent statements are often made in text-books to the contrary.

W. D. H.

**Post-mortem occurrence of Maltose in the Liver.** By R. LÉPINE and BOULUD (*Compt. rend. Soc. Biol.*, 1901, 53, 1061—1062).—In dogs, even if fed exclusively on meat, maltose is found in the liver some hours after death. The tests relied on are polarimetric, and the preparation of maltosazone.

W. D. H.

**Post-mortem occurrence of Glycuronic Acid in the Liver.** By R. LÉPINE and BOULUD (*Compt. rend. Soc. Biol.*, 1901, 53, 1041—1043).—In 12 livers out of 20 (from dogs and guinea-pigs), glycuronic acid is found some hours after death. The same is true for the liver after removal of the pancreas.

The authors rely on polarimetric observations alone for the detection of this substance and its compounds.

W. D. H.

**Reticulin and Collagen.** By M. CHRISTINE TEBB (*J. Physiol.*, 1902, 27, 463—472).—Both tendon and reticular tissue consist of fibres which are histologically identical; the main material of which they are composed is collagen. Reticulin, which Siegfried described as characteristic of reticular tissue, does not exist in either form of connective tissue. Siegfried's reticulin is merely collagen which has been 'coagulated' by the reagents he employed (especially alcohol and ether) *plus* proteid and nuclein residues of cells. After treatment with these reagents, conversion into gelatin is rendered much more difficult by subsequent boiling with water.

W. D. H.

**The Liberation of a Volatile Sulphide from Milk on Heating.** By LEO F. RETTGER (*Amer. J. Physiol.*, 1902, 6, 450—457).—When milk is heated above 85°, a volatile sulphide, probably hydrogen sulphide, is liberated. The amount, although small, suffices to blacken lead acetate paper and to decolorise dilute solutions of potassium permanganate. Alkalis and alkali phosphates favour, whilst acids and acid phosphates retard, this occurrence. It is believed to indicate proteid decomposition, and to explain what some observers describe as the injurious effects of heating milk.

W. D. H.

**The Urine and Kidneys of Fowls fed on Meat.** By FRÉDÉRIC HOUSSAY (*Compt. rend.*, 1901, 133, 1224—1226).—In fowls fed on meat, the amount of urea excreted is increased threefold, as compared with those fed on grain (0.315:0.108). The kidneys are somewhat hypertrophied in the former animals.

W. D. H.

**Excretion of Nitrogen during Nervous Excitement.** By FRANCIS G. BENEDICT (*Amer. J. Physiol.*, 1902, 6, 398—410).—Two experiments were made on individuals suffering from excitement due to the witnessing of football matches. In these cases, no noticeable change occurred in nitrogenous metabolism.

W. D. H.



**Chromic Acid Diabetes.** By JULIUS KÓSSA (*Pflüger's Archiv*, 1902, 88, 627—637).—Compounds of chromic acid such as potassium chromate, when administered by the mouth or subcutaneously, produce a diabetic condition. This is most intense in dogs; in rabbits, it is not so marked. This condition belongs to the group of 'kidney-diabetes,' and is similar to that produced by phloridzin; the amount of sugar in the blood does not increase. W. D. H.

**Iboga Root and Ibogine.** By LAMBERT and HECKEL (*Compt. rend.*, 1901, 133, 1236—1238).—Subcutaneous injections of ibogine (this vol., i, 114, 174) produces in frogs an abolition of voluntary and reflex movements; the excitability of the muscles and nerves is not altered. Sensation is abolished at the seat of injection. Fairly large doses are necessary to produce death. In mammals, convulsions, and then death from respiratory arrest, occur. The heart is weakened, and this effect is not abolished by section of the vagi. W. D. H.

**Valency, Toxic, and Antitoxic Effects of Ions.** By JACQUES LOEB (*Amer. J. Physiol.*, 1902, 6, 411—433).—A fuller account of experiments already described (this vol., ii, 162). W. D. H.

## Chemistry of Vegetable Physiology and Agriculture.

**Action of Tannins and Colouring Matters on the Activity of Yeasts.** By AUGUSTE ROSENSTIEHL (*Compt. rend.*, 1902, 134, 119—122).—Yeast combines with and withdraws from solution the red colouring matter of grape skins and behaves in the same way with respect to tannin. As a result of this absorption, the fermentative power of the yeast is reduced and finally becomes *nil*, although the power of reproduction may still persist.

The absorptive power of yeast for colouring matters varies considerably; it is *nil* for azo-colours, except those derived from benzidine, and is very feeble for dyes of the phthalein group, but is powerful for dyes of the acridine, thionine, safranine, and rosaniline groups.

C. H. B.

**Occurrence of Methylpentosan in Nature.** By P. RAVN SOLLIED (*Chem. Zeit.*, 1901, 25, 1138—1139).—By means of Tollens and Widstoe's method (*Abstr.*, 1900, i, 244), the author has looked for methylpentosan in the needles and leaves of various trees. A feeble reaction was obtained in the case of *Fucus serratus*, *F. vesiculosus*, *Aseophyllum nodosum*, *Betula odorata*, *Fraxinus excelsior*, *Acer*, *Sorbus Aucuparia*, *Tilia grandifolia*, and *Pinus sylvestris*. Quercitron gave a marked reaction.

K. J. P. O.

**Polygonum Persicaria.** By PAUL HORST (*Chem. Zeit.*, 1901, 25, 1055—1056).—The leaves of *Polygonum Persicaria* contain water, 10.07 per cent.; ash, 6.52; ethereal oil, 0.053; wax, 1.92; tannin, 1.52; mucin and pectin substances, 5.42; calcium oxalate, 2.18; total nitrogen, 3.97; ammonia, 0.31; cellulose, 27.61; volatile acids, 0.0464, and sugar, 3.24 per cent. The ash, in addition to the usual constituents, is peculiarly rich in manganese. Petroleum extracted a wax which consisted of an ester of phytosterol and oleic acid, together with free phytosterol and free acids from which oleic acid and a solid acid (m. p. 55°) were isolated. The ethereal extract was mainly chlorophyll and a resin. Alcohol extracted sugar, tannin, gallic acid, quercetin,  $C_{15}H_{10}O_7$ , and phlobaphen; the latter, when purified, is a greyish-brown mass, yielding, on hydrolysis with sulphuric acid, a sugar the osazone of which melts at 177—178°. The volatile bases consisted of a mixture of two or three different substances. Volatile acids (acetic and butyric) form the main portion of the ethereal oil, together with two neutral substances, one of which is a camphor-like solid (*persicariol*) with a pleasant odour.

K. J. P. O.

**Yew Wood (*Taxus Baccata*, L.).** By GEORGE THOMS (*Landw.-chem. Versuchs-u. Samen-Control-Station am Polytech. z. Riga*, 1901, Heft 10, 246—250).—The wood contained 89.34 per cent. of dry matter of the following percentage composition: ash, 0.42; C, 50.92; H, 6.33; O, 42.14, and N, 0.19. The crude ash contained 29.6 per cent. of carbon dioxide.

Percentage composition of the pure ash :

K <sub>2</sub> O.	Na <sub>2</sub> O.	CaO.	MgO.	Fe <sub>2</sub> O <sub>3</sub> .	Mn <sub>2</sub> O <sub>4</sub> .	P <sub>2</sub> O <sub>5</sub> .	SO <sub>3</sub> .	SiO <sub>2</sub> .	Cl.
6.24	1.59	68.69	7.39	2.59	0.17	3.36	7.05	1.07	0.55

The large amount of carbon dioxide in the crude ash is probably derived from calcium oxalate in the wood.

N. H. J. M.

**Presence of Sucrose in the Tubercles of *Carum Bulbocastanum*.** By V. HARLAY (*J. Pharm.*, 1902, [vi], 15, 49—52).—Sucrose has been isolated from the tubercles of *Carum bulbocastanum* (ground-nut), the amount present forming about 10 per cent. of the solid constituents of the tubercles.

H. R. LE S.

**Nutrition of Plants with Phosphorus.** By TH. SCHLÆSING, jun. (*Compt. rend.*, 1902, 134, 53—55).—The phosphorus soluble in water was determined in two soils in which maize had been grown, and in the same soils without vegetation, but which had been kept moist during the same period. The one soil was comparatively rich in phosphorus soluble in water, the other exceptionally poor. The extraction of soluble phosphorus was repeated ten or eleven times, but was not quite completed. The phosphorus in the maize plants was also determined.

The results showed, in the case of the richer soil, that the soluble phosphorus lost by the soil practically accounted for the whole of the phosphorus in the plants. The plants grown in the poorer soil derived about half their phosphorus from the water-soluble phosphorus of the soil.

The laborious determination of the soluble phosphorus in the soil (Abstr., 1899, ii, 119, 243, and 449) was somewhat shortened by dividing the soils into small portions and extracting them all at the same time.

N. H. J. M.

**Effect of Deficiencies of Potassium, Phosphoric Acid, and Nitrogen on Sugar Production and on the External Form of the Beetroot.** By H. WILFARTH, H. RÖMER, and G. WIMMER (*Zeit. Ver. deut. Zuckerind.*, 1901, 993—1013).—The results of pot experiments with sugar beet showed that the absence of potassium, phosphoric acid, and nitrogen each produced characteristic effects on the leaves of the plants. In each case, the roots remained very small.

Sugar production is very slight when potassium is very deficient, and if at the same time, much nitrogen is supplied, the amount of sucrose will be almost nothing and the roots have a great tendency to decompose. The leaf production is comparatively large in absence of potash and essentially greater than when phosphoric acid and nitrogen are absent.

In absence of phosphoric acid, the roots, although small, are quite healthy and fairly rich in sugar as compared with roots grown without potassium. With a deficiency of phosphoric acid which reduces the weight of the roots to 13·8 grams, the amount of sugar is as high as 14 per cent.

When nitrogen is deficient, healthy roots with much sugar are produced. Roots weighing only 15 grams may contain 17·8 per cent. of sugar.

N. H. J. M.

**Studies in the Chemical Analysis of Fresh and Salt Waters. Part I. Applications of the Aëration Method of Analysis to the Study of River Waters.** By WALTER E. ADENEY (*Sci. Proc. Roy. Dublin Soc.*, 1900, 9, 346—361).—The advantages of the author's aëration method of analysis (Abstr., 1896, ii, 322) are pointed out, and the conclusions that may be deduced from it are illustrated by a detailed examination of three waters: (1) a slightly polluted non-tidal water; (2) a potable water; (3) a tidal water. Stress is laid on the necessity of determining in a water, not only the dissolved oxygen, but all the dissolved gases.

J. C. P.

**Nature and Speed of the Chemical Changes which occur in Mixtures of Sewage and Sea Water.** By EDMUND A. LETTS, ROBERT F. BLAKE, W. CALDWELL, and J. HAWTHORNE (*Sci. Proc. Roy. Dublin Soc.*, 1900, 9, 333—345).—An investigation of a preliminary character. Mixtures of sewage and sea-water were kept in closed vessels for a number of days, and the quantity of the various dissolved gases determined at intervals. It seems that the first chemical change is the absorption of oxygen and the production of almost the equivalent quantity of carbon dioxide. A comparison of the analyses of the dissolved gases and the amount of 'oxygen absorbed' as given by the permanganate test shows that a more energetic oxidation is effected by micro-organisms and free oxygen than by the permanganate solution. Free and albuminoid ammonia, nitrates, and nitrites were

determined at the same intervals, and it appears that in the earlier stages of the fermentative process, interchanges took place between the free and the albuminoid ammonia.

Mixtures of sewage and sea-water were kept also in open vessels, and the changes studied in a similar fashion, but the experimental data are not yet numerous enough to warrant any general conclusions.

J. C. P.

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## Analytical Chemistry.

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**The Employment and Sensibility of Litmus Extract.** By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1902, [vii], 25, 39—53).—Litmus extract gives definite end points with acids, the heats of neutralisation of which lie between 13.6 and 16 Cal., this being the value obtained for each hydrogen ion neutralised in dilute solution. The end point is, however, indeterminate in the case of those acids in which this constant is approximately 11—12 Cal., and, moreover, it varies with the degree of dilution. The behaviour of litmus employed as an indicator under various conditions is fully discussed, but the remainder of the communication is not suitable for abstraction (compare Abstr., 1901, ii, 502, 551).

G. T. M.

**Indicators.** By F. GLASER (*Zeit. anal. Chem.*, 1902, 41, 36—42).—To the strictures of J. Wagner (Abstr., 1901, ii, 419) on the author's classification of indicators, it is replied that it was intended for practical purposes, and to Wagner's proposed classification according to the mode of their ionisation, it is objected that the constitution of many indicators is at present unknown, that many coloured substances of essentially different chemical constitution have an equal practical efficiency as indicators, and that Wagner's classification groups together indicators which behave very differently in actual use. Wagner's conclusions with regard to Congo-red seem to be due to an error in the work of Schimansky (Abstr., 1900, i, 305). The blue substance precipitated by adding hydrochloric acid to Congo-red does not contain chlorine, neither does it change in colour by exhaustive washing in a platinum vessel. If, however, transferred to a glass vessel, it dissolves with red colour in consequence of the solution of alkali from the glass.

M. J. S.

**Gravimetric Method for the Estimation of Hydrogen Peroxide.** By GEORGE E. HOSCH (*J. Amer. Chem. Soc.*, 1901, 23, 923—924).—The drying tube of a Schrötter's apparatus (as employed for the estimation of carbonates) is half filled with concentrated sulphuric acid, the 'acid tube' with a 2 per cent. solution of potassium permanganate, and in the bulb are placed 10 c.c. of water and 5 c.c. of dilute sulphuric acid (1:5). The weight of the apparatus is noted both before and after the addition of about 1 c.c. of the hydrogen



peroxide solution. The permanganate is allowed to enter drop by drop until a permanent coloration is produced. The apparatus is allowed to cool, and is then weighed. One-half of the loss in weight is due to oxygen of the hydrogen peroxide.

E. G.

**Estimation of Sulphur in Proteids.** By THOMAS B. OSBORNE (*Zeit. anal. Chem.*, 1902, 41, 25—35).—See this vol., i, 250.

**Estimation of Small Amounts of Hydrogen Sulphide in Natural Waters.** By LUDWIG W. WINKLER (*Zeit. anal. Chem.*, 1901, 40, 772—774).—When the amount of hydrogen sulphide is extremely small, the Dupasquier-Fresenius method is useless, and in such cases, a colorimetric method may be employed. The solutions required are: (1) 25 grams of sodium potassium tartrate, 5 grams of sodium hydroxide, and 1 gram of lead acetate made up to 100 c.c. (2) 0.0367 gram of arsenic trisulphide dissolved in ammonia and made up to 100 c.c., each c.c. of this solution corresponds with 0.1 c.c. of hydrogen sulphide at 0° and 760 mm. The solution must be freshly made.

A measured quantity of the natural water is mixed with about 5 per cent. of reagent (1), and the depth of colour is matched by adding reagent (2) from a burette to a similar mixture of reagent (1) with distilled water.

M. J. S.

**Estimation of Free Sulphuric Acid in Leather.** By J. PAESSLER and H. SLUYTER (*Chem. Centr.*, 1902, i, 137—138; from *Bull. assoc. belge Chimistes*, 15, 313—321).—A criticism of the methods proposed by Balland and Maljean (*Abstr.*, 1896, ii, 499), Jean (*Rev. intern. falsific.*, 8, 188), Procter and Searle (*Leather Trades Rev.*, 1901) and Schroeder.

The first method suffers from the defect that the natural sulphur of the leather is disregarded; this may be remedied by deducting 0.14 per cent. from the sulphur trioxide found. It must be remembered that in this method some normal sulphates such as those of iron, aluminium, and chromium lose their sulphuric acid on ignition, and this loss should be allowed for when calculating the amount of free acid.

Jean's process gives too low results, as leather retains free acids which cannot be removed by solvents.

Procter and Searle's method is based on the same principle as Helmer's process for the estimation of mineral acids in vinegar. The authors state that the alkalinity of the ash from another piece of the sample should always be determined and allowed for. With some kinds of leather, the method gave negative results from some unexplained cause.

In Schroeder's process, the sulphuric acid and sulphates are extracted with 1 per cent. hydrochloric acid. The authors found that pure water scarcely extracts the acid.

L. DE K.

**Gasometric Estimation of Sulphates and Carbonates.** By E. RIEGLER (*Zeit. anal. Chem.*, 1902, 41, 17—25).—Barium chloride, when treated with iodic acid, forms barium iodate, and the latter, when treated with hydrazine sulphate, evolves nitrogen according to the equation  $\text{Ba}(\text{IO}_3)_2 + 3\text{N}_2\text{H}_4 \cdot \text{H}_2\text{SO}_4 = \text{BaSO}_4 + 2\text{H}_2\text{SO}_4 + 2\text{HI} + 6\text{H}_2\text{O} + 3\text{N}_2$ . The

slightly acidified solution of the sulphate (30—40 c.c.) is treated with an excess of barium chloride (30.5 grams of the crystallised salt in a litre), taking care that the excess does not exceed 5 c.c. The mixture is boiled and allowed to cool; there is then added 5 c.c. of a 6 per cent. solution of iodic acid, and after 15 minutes the mixed precipitate is collected on a small filter and washed until the total filtrate amounts to 100 c.c. The filter with its contents is then placed in the reaction flask of a Knop-Wagner azotometer and treated in the usual way with 40 c.c. of a 2 per cent. solution of hydrazine sulphate. The reaction is complete when the contents of the flask become colourless. The nitrogen is calculated into  $\text{SO}_3$  (by a table which is supplied); a correction of 3.5 mg. is added for the solubility of barium iodate (22.4 mg. in 100 c.c.) and the amount is deducted from 10 times the number of c.c. of barium chloride employed.

For estimating carbonates, the carbonic acid is precipitated by barium hydroxide; the precipitate is well washed, dissolved in a small excess of hydrochloric acid, and the barium chloride treated as just described. The correction for solubility is in this case 2.1 mg. of carbon dioxide.

M. J. S.

**Estimation of Nitrogen.** By E. DURAND (*Ann. Chim. anal.*, 1902, 7, 17—18).—The author recommends the apparatus formerly used by Kjeldahl, which does not seem to be generally known. It consists of a distilling flask of 800 c.c. capacity, made out of a single piece of copper. The flask is connected with the condenser by means of a Kjeldahl-Stutzer bulb apparatus.

When using this copper distilling flask, it is as well to avoid the introduction of mercurial compounds, and the conversion of the nitrogen into ammonia should be effected by means of sulphuric acid and a little copper oxide (compare Jean, this vol., ii, 172).

L. DE K.

**Mitscherlich's Test for Phosphorus in presence of Alcohol.** By JOSEF HABERMANN and A. OESTERREICHER (*Zeit. anal. Chem.*, 1901, 40, 761—766).—It is well known that the phosphorescent luminosity, which in Mitscherlich's test is the characteristic evidence of the presence of free phosphorus, is prevented by the presence of many volatile organic substances, of which alcohol is the one most likely to be present in a chemico-toxicological examination. If the quantity of phosphorus present is very small compared with the alcohol, it may be impossible to distil off the alcohol without the whole of the phosphorus passing over also, in which case the luminosity may be entirely prevented. The authors, however, find that by adding water to the distillate, the disturbing effect of alcohol may be to a great extent eliminated. A better plan is to insert the jet of a stop-cock funnel into the upper end of the Liebig's condenser, and to allow cold water to drop from the funnel during the distillation. A luminous band will then be observed in the condenser. If the liquid under examination contains more than 50 vols. per cent. of alcohol, even this method fails, but by adding water to the contents of the distillation flask prior to distilling, the luminosity will be observed even when the original liquid consisted of absolute alcohol.

M. J. S.

**Behaviour of Calcium Hypophosphite in the Animal System.** By THEODOR PANZER (*Zeit. Nahr. Genussm.*, 1902, 5, 11—14).—Experiments with dogs showed that calcium hypophosphite is rapidly eliminated from the system and passes unaltered into the urine. The presence of hypophosphite may be generally detected after half-an-hour, and no more can be found after 24 hours. The other organs, blood, and faeces are practically free from hypophosphite. In human beings the elimination seems to take a little longer.

In case of a supposed poisoning by phosphorus, enquiries should be made as to whether the person has taken any hypophosphite shortly before death; should this be proved, the presence of phosphorous acid in the urine or intestinal canal counts for nothing. L. DE K.

**Estimation of Phosphoric Acid in Organic Substances.** By FRITZ RIEGER (*Zeit. physiol. Chem.*, 1901, 34, 109—113).—The method consists in evaporating the substance, for example, milk, to a syrup in a platinum dish, then heating with a relatively large amount of finely divided sodium carbonate, and finally with sodium carbonate and potassium nitrate. The fused mass is dissolved in nitric acid, and the phosphoric acid precipitated by ammonium molybdate in the usual manner. A modified Keller's method (*ibid.*, 1900, 29, 150) has also given good results.

A third method consists in precipitating the proteids in milk by the aid of copper sulphate and sodium hydroxide (Ritthausen, this Journal, 1877, ii, 519), and estimating the phosphorus in this precipitate by fusion with sodium carbonate and potassium nitrate. J. J. S.

**Detection of Traces of Arsenic in Articles of Food.** By J. C. BERNTRUP (*Zeit. anal. Chem.*, 1902, 41, 11—13).—The arsenic is converted into arsenic acid by adding bromine; sodium phosphate and magnesia mixture are then added. The precipitate of magnesium ammonium phosphate carries down the magnesium ammonium arsenate. The precipitate is washed with ammonia, dissolved from the filter by dilute sulphuric acid, and the solution evaporated with addition of nitric acid until fumes of sulphuric acid begin to volatilise. All organic matter is thus got rid of; the solution is fit for either Marsh's or Gutzeit's test, and there is no danger of interference from antimony if originally present. M. J. S.

**Boric Acid.** By K. FARNSTEINER (*Zeit. Nahr. Genussm.*, 1902, 5, 1—8).—Instead of using dilute glycerol as a solvent, the author has successfully estimated boric acid by dissolving it in absolute methyl alcohol and titrating with  $N/2$  solution of potassium, sodium, or barium hydroxide (also dissolved in absolute methyl alcohol), using phenolphthalein as indicator. It is necessary to continue the titration until the end reaction is very marked, as a very slight pink will show before the reaction is quite finished. The solution may be titrated after being kept for 24 hours. The distillate obtained by heating boric acid with methyl alcohol, which is supposed to contain methyl borate may be titrated almost as readily as if it were a solution of boric acid.

If crystallised borax is titrated in this manner, half of its boric

acid is practically obtained; the results are a trifle too low, no doubt owing to the hydrolysing influence of the water of crystallisation.

Absolute ethyl alcohol cannot be substituted for methyl alcohol, as the end reaction is then reached when only one-sixth or one-seventh of the acid has been converted into the normal salt. On using 95 per cent. alcohol, results are obtained in which the proportion of boric acid and alkali varies from about 2.36, 2.18, or 2 to 1, instead of showing the normal proportion 1 to 1. No satisfactory explanation can as yet be given.

L. DE K.

Some Problems connected with Atmospheric Carbon Dioxide, and a New and Accurate Method for Estimating its Amount Suitable for Scientific Expeditions. By EDMUND A. LETTS and ROBERT F. BLAKE (*Sci. Proc. Roy. Dublin Soc.*, 1901, 9, 436—453. Compare Abstr., 1900, ii, 622).—In the authors' opinion, the study of the variation of the amount of atmospheric carbon dioxide under varying conditions of wind, weather &c., especially above the ocean, is of great importance. Accordingly, a method of estimating the carbon dioxide of the atmosphere is here described, which involves only comparatively simple operations at the place of observation. The method resembles Pettenkofer's in that a relatively small volume of air is examined, but a dilute (approximately  $N/40$ ) solution of potash is used to absorb the carbon dioxide, which is afterwards liberated by treatment with acid and measured; the latter part of the process is carried out with Adeney's apparatus (*Trans. Roy. Dublin Soc.*, 1895, [ii], 5, 548), which is found to give very accurate results. The authors describe and sketch the apparatus used for transferring an accurately measured quantity of the absorbent into the receiver containing the air to be examined, the absorbent being all the time out of contact with the external atmosphere. The correction necessary for any carbon dioxide already present in the absorbent is determined by a blank experiment. The authors have tested their method by using artificial mixtures of pure air and carbon dioxide; the mean error in their experiments is 0.04 part per 10,000 of air, and the method is therefore accurate enough to determine the fluctuations in the amount of atmospheric carbon dioxide.

A modification of the process, suitable for field work or for scientific expeditions, is also proposed, in which sealed tubes, each containing 50 c.c. of the weak potash solution, are prepared beforehand. When a tube is to be used, its ends are broken and, by suitable means, the contained solution is brought into contact with the air to be examined; after the absorption is complete, the solution is re-introduced into the tube, the latter is sealed again, and its contents may be examined subsequently.

J. C. P.

Estimation of Sodium and Potassium in Urine. By G. C. GARRATT (*J. Physiol.*, 1902, 27, 507—510).—A slight modification of Lehmann's method is proposed, and also a simpler method, which gives nearly accurate results.

W. D. H.

Relations of Absorption to Analytical and Agricultural Chemistry. By ROBERT SCHALLER (*Zeit. angew. Chem.*, 1901, 14, 1294—1296).—The results of estimations of calcium in soil extracts



after precipitating the iron with ammonia, showed in some cases that more than half the calcium is lost owing to its being absorbed by the ferric hydroxide. It is shown that the absorption of calcium increases with the concentration, but that relatively less is lost in strong than in weak solutions. The loss of calcium also increases with the amount of iron in solutions containing the same amount of calcium.

Mechanical absorption by ferric hydroxide also occurred in the case of magnesium hydroxide and potassium dichromate. N. H. J. M.

**Report of the American Sub-Committee on Uniformity in Analysis of Materials for the Portland Cement Industry.** [CLIFFORD RICHARDSON, SPENCER B. NEWBERRY, and H. A. SCHAFFER] (*J. Soc. Chem. Ind.*, 1902, 21, 12—30).—The committee has examined 18 different schemes for the analysis of Portland cement, and recommends the following tentative method: 0.5 gram of the finely powdered material is strongly ignited in a platinum crucible for 15 minutes, transferred to a platinum dish, and treated with 50 c.c. of water and 10 c.c. of hydrochloric acid; the whole is finally evaporated as nearly as possible to dryness on a water-bath. *Silica.* The residue is treated with 5—10 c.c. of strong hydrochloric acid, and, after adding water, the whole is heated for 10 minutes on the water-bath, and the silica collected on a filter and washed. The filtrate is again evaporated to dryness and the residue taken up with acidified water, when the small amount of additional silica is again collected. The two filters containing silica are then transferred while moist to a platinum crucible and gradually heated, finally over a blowpipe, until constant weight is obtained. The purity of the silica may be tested as usual with hydrofluoric acid. *Aluminium and ferric oxides.* The filtrate from the silica is made alkaline with ammonia, well boiled, and the precipitate collected and washed, once by decantation and slightly on the filter. It is then dissolved in hydrochloric acid and reprecipitated by ammonia and the precipitate is ignited and weighed. *Ferric oxide.* The precipitate is fused with potassium hydrogen sulphate, the fused mass dissolved in hot water and 25 c.c. of dilute sulphuric acid. The small amount of silica is collected and weighed. The filtrate is treated with hydrogen sulphide, the excess of this boiled off whilst a current of carbon dioxide is passed, and the ferrous iron then titrated with permanganate. *Calcium oxide.* To the filtrate from the aluminium and iron are added a few drops of ammonia, the solution is boiled, and 10 c.c. of a saturated solution of ammonium oxalate are added. The precipitate is collected and placed while moist in a platinum crucible, when it is gradually ignited. The ash is redissolved in a little hydrochloric acid and diluted with water to about 100 c.c., ammonia is added in slight excess and the liquid boiled and reprecipitated with ammonia oxalate. If the ammonia should produce a slight precipitate of alumina, this should be collected and weighed. The calcium oxalate, now pure, is titrated with permanganate or else converted into oxide by ignition over the blast and weighed. *Magnesium oxide.* The filtrates from the calcium are acidified with hydrochloric acid, concentrated to about 150 c.c., and mixed with 30 c.c. of a saturated solution of microcosmic salt; the whole is then boiled for a few minutes. When cold, ammonia is slowly

added while stirring until the crystalline precipitate begins to form ; a slight excess of ammonia is then added, and the stirring continued for a few minutes. After a few hours, the precipitate is collected, re-dissolved in hot dilute hydrochloric acid, diluted to 100 c.c., mixed with 2 c.c. of phosphate solution, and again precipitated by ammonia as before. After two hours, it is collected, ignited, and weighed. *Alkalis.* The sample is heated as usual with ammonium chloride, but there is no need to add calcium carbonate. *Sulphur trioxide.* One gram of the sample is dissolved in 15 c.c. of hydrochloric acid, and the solution diluted with water and filtered. Without troubling about the dissolved silica, the solution is heated to boiling and mixed, drop by drop, with 10 c.c. of a saturated solution of barium chloride. The barium sulphate is collected and weighed. *Total sulphur.* One gram of the sample is similarly treated after a preliminary fusion with sodium carbonate and a little potassium nitrate, avoiding contact with sulphurous gases. *Loss on ignition.* 0.5 gram of the sample is heated for 15 minutes over the blowpipe and weighed ; the loss in weight is checked by another 5 minutes' ignition.

If the sample should not entirely dissolve in hydrochloric acid, the insoluble matter should be collected and rendered soluble by a preliminary fusion with sodium carbonate. The aluminium-iron precipitate may contain also traces of titanium, manganese, and phosphoric oxides.

L. DE K.

**Microchemical Test for Magnesium.** By M. E. Pozzi-Escot (*Ann. Chim. anal.*, 1902, 7, 10—11).—A reply to several criticisms. When dealing with extremely dilute solutions, the addition of ammonia to the mixture of magnesium salt, ammonium chloride, and sodium phosphate is advantageous, and a crystalline deposit will be obtained.

L. DE K.

**Analysis of Crude Copper and Mattes. Part I.** By P. TRUCHOT (*Ann. Chim. anal.*, 1902, 7, 1—5. Compare Abstr., 1900, ii, 197).—The copper borings or filings are freed from any adhering particles of metallic iron by means of a magnet and, if greasy, washed with ether. Mattes are reduced to powder and passed through a No. 100 sieve. Any coarse particles of metallic copper are collected, weighed, and analysed separately ; they only occur in blue or bronze, but not in white mattes. Ten grams of black copper or mattes are treated with a mixture of 50 c.c. of nitric acid of sp. gr. 1.3 and 10 c.c. of sulphuric acid of sp. gr. 1.6, and sufficient water is added to moderate the violence of the reaction. When the action has ceased, any particles of unoxidised sulphur are dissolved by adding a few c.c. of bromine. After adding 5 c.c. of sulphuric acid, the liquid is evaporated until sulphuric acid fumes have practically ceased ; the residue is dissolved in dilute sulphuric acid and the undissolved portion, consisting of oxides of tin and antimony, lead sulphate, &c., washed with water to which a few drops of sulphuric acid have been added.

*Estimation of lead.* The insoluble matter is digested with 25 c.c. of a saturated solution of ammonium acetate. To the filtrate are added

40—50 c.c. of nitric acid and sufficient water to bring the volume up to 300 c.c.; the solution is submitted to electrolysis, using a current of 0.2 ampere and 2.5 volts, which causes the lead to precipitate as dioxide; this is then washed, dried at  $180^{\circ}$ , and weighed. In this and subsequent electrolyses, the surface of the anode, or cathode, has always been 80 decimetres square.

*Estimation of copper.* The original solution is mixed with 10—15 c.c. of nitric acid, diluted to 300 c.c., and electrolysed, using a current of 0.4 ampere and 2.5 volts; the operation, which takes about a day and a half, may be accelerated by using at first a current of 1.5 amperes. From the weight of the copper thus obtained, any silver afterwards found must be deducted. The liquid is now evaporated on a sand-bath until the sulphuric acid is completely expelled, the residue dissolved in hot dilute hydrochloric acid, and after heating at  $80^{\circ}$  to  $85^{\circ}$ , freed from any arsenic, antimony, tin, bismuth, &c., by a current of hydrogen sulphide. The filtrate is boiled and fully oxidised by a few drops of bromine, the excess of which is expelled by boiling a little longer. *Estimation of iron.* The liquid is neutralised with sodium carbonate and the iron precipitated by adding 10—20 grams of sodium acetate and boiling. The precipitate is redissolved and reprecipitated, and then purified a third time by reprecipitation with ammonia. It is finally dissolved in dilute sulphuric acid and titrated with permanganate. *Estimation of zinc.* The united filtrates from the iron are evaporated with hydrochloric acid, the chlorides are dissolved in water, and mixed with sodium carbonate until a slight precipitate has formed, which is redissolved by adding 1 or 2 drops of hydrochloric acid. A current of hydrogen sulphide is passed and a few drops of a very weak solution of sodium acetate are added. The precipitated zinc sulphide is freed from traces of cobalt and nickel by boiling with dilute hydrochloric acid and finally adding an excess of sodium hydroxide, which dissolves the zinc oxide and leaves cobalt and nickel oxides undissolved. The zinc is then deposited on platinum coated with copper by electrolysis, using a current of 0.4 ampere and 3 volts. *Estimation of manganese.* The filtrate from the zinc is boiled to expel hydrogen sulphide and then mixed with the solution obtained on dissolving the nickel and cobalt oxides, which are recovered from the zinc sulphide, in hydrochloric acid. The manganese is precipitated by adding ammonium phosphate and excess of ammonia. The manganous ammonium phosphate is washed with dilute ammonia, redissolved in hydrochloric acid, and afterwards titrated in the usual manner with permanganate. *Estimation of nickel and cobalt.* The filtrate from the manganese is submitted to electrolysis, using a current of 0.5 ampere and 3 volts; this gives the joint amount of nickel and cobalt. The latter is then separated by the potassium nitrite method and finally electrolysed in the presence of ammonium phosphate and ammonia. *Estimation of arsenic and antimony.* The author uses Hollard's method (Abstr., 1900, ii, 442).

L. DE K.

**Estimation of Copper in Pyrites.** By HERBERT HAAS (*Zeit. anal. Chem.*, 1901, 40, 789).—With reference to Heidenreich's method (Abstr., 1901, ii, 197), the author objects that electrolytic precipitation

does not fulfil the condition of rapidity which is essential in a copper works. By dissolving the precipitated copper in nitric acid and titrating with cyanide, identical results are obtained and more rapidly.

M. J. S.

**Solubility of Copper Sulphide in Alkali Sulphides: Separation of Copper, Lead, Antimony, and Tin.** By ADELBERT RÖSSING (*Zeit. anal. Chem.*, 1902, 41, 1—11).—The common practice of employing sodium polysulphide, either in the dry or wet way, for the separation of copper and lead from antimony and tin, leads to errors, since copper sulphide is appreciably soluble in alkali polysulphides. In sodium monosulphide, copper sulphide is practically insoluble, but since stannous sulphide is not soluble in that reagent, it is necessary that all the tin should be in the stannic condition. The method of separating antimony and tin from lead and copper, in analysing alloys, by oxidation with nitric acid, cannot be recommended, as both the latter metals are invariably found in the insoluble residue. If, however, the residue left after evaporating the nitric acid is at once treated with colourless sodium sulphide (after ensuring the absence of acid by adding a little sodium hydroxide) a complete separation can be effected. A more rapid method is to dissolve the alloy (2 grams) in a little nitrohydrochloric acid, warm the solution with potassium chlorate, dilute with water containing tartaric acid, make feebly alkaline with sodium hydroxide, and add colourless sodium sulphide in the smallest possible excess. For separating the antimony and tin in the filtrate, a modification of Clark's method is advisable. The solution is decolorised by hydrogen peroxide, nearly neutralised with hydrochloric acid, mixed with 25—30 grams of oxalic acid, and treated for half-an-hour with hydrogen sulphide. It is well to dissolve the precipitated antimony sulphide once more in sodium sulphide and repeat the precipitation after adding 15—20 grams of oxalic acid, as traces of tin are present in the first precipitate. The filtrate is then made alkaline with ammonia, ammonium sulphide added, and the stannic sulphide thrown down by acetic acid. Hydrogen sulphide should be passed, as a considerable excess is necessary to ensure the complete precipitation of the tin. The antimony sulphide should be freed from sulphur by treatment with a mixture of alcohol and carbon disulphide, removed completely from the filter, and heated with fuming nitric acid until the last traces of sulphur are oxidised, since the ignition of antimony tetroxide with sulphur invariably causes loss.

M. J. S.

**Estimation of Molybdic Acid reduced by Hydriodic Acid.** By FRANK A. GOOCH and O. S. PULMAN, jun. (*Amer. J. Sci.*, 1901, [iv], 12, 449—451).—0.3—0.5 gram of the molybdate compound is boiled with 40—60 c.c. of hydrochloric acid of sp. gr. 1.2 containing 0.2—0.6 gram of potassium iodide in a 150 c.c. flask trapped loosely by means of a short bulbed tube hung in the neck. The boiling is continued until the volume of the liquid is reduced to exactly 25 c.c.; it is diluted with cold water to 125 c.c. and transferred to a Drexel wash-bottle fitted with a ground glass stopper carrying the usual inlet and outlet tubes. To the inlet tube is sealed a separating funnel for the gradual



introduction of reagents, and to the outlet tube a Will and Varrentrap bulb apparatus containing solution of potassium iodide to prevent any mechanical loss of iodine during the subsequent neutralisation. Through the funnel is added a solution of 0.5 gram of manganous sulphate, and from a burette a  $N/10$  solution of potassium permanganate until the solution assumes the characteristic colour. From a burette is then added a quantity of standard solution of sodium arsenite corresponding in strength with the permanganate used. To prevent precipitation of molybdic oxide on neutralising, a solution of 3 grams of tartaric acid is added and the acids are then neutralised with potassium hydrogen carbonate. The liquid adhering to the stopper and tubes and also the contents of the bulbs are rinsed into the bottle and the residual arsenite is titrated with standard iodine, using starch as indicator. The theory of the process is plain: the value in terms of molybdic acid of the permanganate used, diminished by that of the arsenite and increased by that of the iodine, gives the amount of molybdic acid present. L. DE K.

**Titration with Stannous Chloride.** By FRÉDÉRIC WEIL (*Compt. rend.*, 1902, 115).—Titrations with stannous chloride can be accurately carried out at the ordinary temperature if the liquid is mixed with an excess of hydrochloric acid and some fragments of white marble are added so that the vessel becomes filled with carbon dioxide. C. H. B.

[**Estimation of Vanadium.**] By H. PROCTER SMITH (*J. Soc. Chem. Ind.*, 1902, 21, 1183—1188).—*Estimation of Vanadium in Ores containing Lead, Copper, Iron, &c.*—A quantity of the sample containing about 0.05 gram of vanadium is dissolved in a little hydrochloric acid, the solution is diluted to 250 c.c. and treated with hydrogen sulphide. The liquid is filtered, and the precipitate redissolved in a little nitric acid; the bulk of the acid is expelled by evaporation, and after dilution with water the solution is again treated with hydrogen sulphide. The two filtrates are mixed and evaporated to dryness in a platinum crucible; the residue contains the vanadium and the iron. It is then fused with an excess of a mixture of 2 parts of dry sodium carbonate and 1 part of nitre for 20—30 minutes. The fused mass is extracted with hot water, and the filtrate, after the addition of sulphuric acid, is gently heated to expel most of the nitrous fumes. The whole is now diluted to 400 c.c., 3 grams of crystallised sodium sulphite are added, and the liquid boiled until no more sulphur dioxide is evolved. It is then titrated while hot with  $N/20$  potassium permanganate until the pink colour is permanent for half a minute.

*Estimation of Vanadium in Ferro-Vanadium Steels.*—The hydrochloric acid solution is oxidised with potassium chlorate and evaporated in a platinum crucible; the residue is fused with the oxidising mixture and treated as in the former case. The theory of the process is that sulphur trioxide reduces vanadium pentoxide to the state of tetroxide, which is reoxidised by permanganate to the pentoxide. L. DE K.

**Bismuth Assay.** By A. W. WARWICK and T. D. KYLE (*Chem. News*, 1902, 85, 3—4).—One gram of finely crushed ore is evaporated

to dryness with 5 to 10 c.c. of concentrated nitric acid, the residue is warmed with 5 c.c. of nitric acid, and treated first with 25 c.c. of water, then made up to 100 c.c. with hot water. The solution is boiled vigorously for 5 minutes with 5 grams of ammonium oxalate, and the solution and subsequent washings are decanted through a filter. The precipitate is boiled with successive quantities of about 50 c.c. of water until a filtrate neutral to litmus is obtained. The basic bismuth oxalate is dissolved by warming with 2 to 5 c.c. of hydrochloric acid diluted with an equal quantity of water, the solution made up to 250 c.c. with hot water, neutralised with ammonia, and the precipitate redissolved by dilute sulphuric acid (1 of acid to 4 of water), which is added a few c.c. in excess. The solution is then titrated with permanganate.

D. A. L.

**Estimation of Hardness in Water.** By W. APPELIUS (*Chem. Centr.*, 1902, i, 137; from *Bull. assoc. belge Chimistes*, 15, 322—325).—Hehner's process of titrating water with standard hydrochloric acid, using methyl-orange as indicator, is very accurate for the temporary hardness, but is less suitable for the estimation of the permanent hardness, in which case Clark's process is preferable.

L. DE K.

**Apparatus for the Mechanical Analysis of Soils.** By A. GAWALOWSKI (*Zeit. anal. Chem.*, 1901, 40, 776—781).—Two forms of apparatus are described for the separation of the soil constituents of different degrees of fineness. The first is a conical flask through which a current of water is drawn by a syphon which can be depressed to different depths (indicated by graduations on the vessel). The second is a nest of three spherical sieves, the innermost of which has meshes 2 mm. square, the next meshes of 1 mm., and the outermost meshes of 0.5 mm. The weighed soil is placed in the inner sieve and the nest is hung in running water by a cord, and is occasionally gently shaken until the water is no longer rendered turbid. The three sieves are then dried and their contents weighed. The results obtained with both forms agree closely with those yielded by Nöbel's levigation apparatus.

M. J. S.

[**Examination of Lemon Oil.**] By HERBERT E. BURGESS and J. F. CHILD (*J. Soc. Chem. Ind.*, 1902, 21, 1176—1182).—The authors state that the determination of the specific gravity, optical rotation, and percentage of citral, coupled with the rotation after distilling the first 10 per cent. are by no means adequate to guarantee the genuineness of the samples.

According to the B. P. and other books of reference, the sp. gr. of the oil varies from 0.857—0.860, but according to the authors even 0.857 is too high a standard. The optical rotation proves that a range of  $\alpha_D + 58^\circ - + 63^\circ$  (100 mm. tube) is quite compatible with a genuine oil; the observations may be made at a temperature of 15—20°. The fractional distillation test, namely, the determination of the rotation of the first 10 per cent., which, according to the B. P., should not differ more than 2° from the original sample, is, in the authors' opinion, absolutely worthless. For the estimation of citral, four methods have

been proposed; of these, the treatment with a saturated solution of sodium hydrogen sulphite and Tiemann's process with normal sodium sulphite are the most trustworthy, as they give almost theoretical results. The percentages of citral as found by the authors is about 4, such a percentage as 7 or 8 being highly improbable.

The usual adulterants are: lemon terpenes, turpentine, lemon grass oil, citral, and less frequently, distilled lemon oil, cedarwood oil, and stearin.

These may be detected by the determination of the sp. gr. at 15°, the optical rotation in a 100 mm. tube, the refractive index at 20°, the percentage of citral, and finally, by fractional distillation. The latter is carried out as follows: 100 c.c. of the sample are put into a distilling flask having three bulbs blown in the neck and fitted with cork and thermometer. This is connected to a condenser with a suitable receiver having two vessels graduated at 10 c.c. and 80 c.c. A Brühl's apparatus answers the purpose. The whole is exhausted and a pressure of not more than 15 mm. should be maintained. The flask is then gently heated by means of an oil-bath. The first 10 c.c. should not take less than 7 minutes to distil. The next vessel is then put into position and the distillation continued until 80 c.c. have passed over. The pressure is then relieved, and the residual oil distilled over with steam, the quantity so obtained being carefully noted. The three fractions are then examined by the polariscope, and by Zeiss's refractometer.

Tiemann's process for the estimation of the citral has been slightly modified by the authors: A saturated solution of sodium sulphite is prepared and made faintly alkaline to phenolphthalein by means of sodium hydroxide. To 50 c.c. of this solution, 25 c.c. of the oil are added, and also two drops of an alcoholic solution of phenolphthalein; the whole is then heated on a water-bath nearly to the boiling point, the vessel being constantly shaken. Sulphurous acid is added drop by drop until the red colour no longer returns. The residual oil is then measured as usual.

Tables are given showing the analytical figures of undoubtedly genuine oils, oils adulterated with terpenes, turpentine and citral, and of terpeneless oils of lemon; also the results of their fractional distillation. With the aid of these tables any gross adulteration may be readily detected.

L. DE K.

**Estimation of Ethyl Alcohol by Nicloux's Method.** By M. E. Pozzi-Escor (*Ann. Chim. anal.*, 1902, 7, 11—12).—The author has tried Nicloux's process based on the reduction of an acid solution of potassium dichromate, and states that "all the alcohols which may occur in fermented liquids behave in the same way as ethyl alcohol, and aldehyde itself exercises a reducing action notwithstanding Nicloux's denial of the fact."

L. DE K.

**Clinical Detection and Estimation of Dextrose in Urine by means of *o*-Nitrophenylpropionic Acid.** By GUGLIELMO RUINI (*Gazzetta*, 1901, 31, ii, 445—451).—According to the author's results, the best solution of *o*-nitrophenylpropionic acid for the detection of dextrose in urine is prepared by dissolving 0.3 gram of the acid in

100 grams of quite cold 6 per cent. sodium hydroxide solution ; this scarcely alters when kept. The urine is boiled for a short time with the solution and immediately after cooling the liquid is mixed with chloroform, to which the indigotin formed imparts a more or less intense violet coloration. The reaction is more striking if the urine is previously clarified by means of neutral lead acetate solution, but this cannot be done if hydrogen sulphide or any other sulphide is present. The reaction is not affected by albumin, hemi-albumose, peptones, uric or hippuric acid, the pigments, or by various salts among which are the hyposulphites found in the urine of the dog. Some substances however, which are not definitely determined, but which probably include creatinine and glycuronic acid, give the indigo reaction, but only when so much as 30 drops of the urine are employed for the test ; these compounds are only partially thrown down by the addition of lead acetate, but they are completely precipitated by mercury salts. In such cases, the author has found it useful to compare the reactions of the urine before and after removing the dextrose by fermentation with pure beer yeast. Bearing in mind these considerations, the indigo reaction gives a sufficiently accurate measure of the sugar in urines, especially in those slightly diabetic. The estimation is made by determining the volume of the urine (in drops) necessary to give a violet coloration to the chloroform and comparing the results obtained with urines containing known proportions of dextrose (0.2—5 grams per 100 c.c.) ; if much sugar is present, the urine must be suitably diluted before applying the test.

A few urines have been examined after ingestion by the patient of various drugs, but in no case has any influence on the indigo reaction been detected.

T. H. P.

**Estimation of Small Quantities of Dextrose in Urines and in Organic Liquids in General.** By ENRICO REALE (*Gazzetta*, 1901, 31, ii, 452—460).—When liquids containing small quantities of dextrose, and especially certain urines, are heated with Fehling's solution, a clear filtrate cannot be obtained by using a filter paper or an asbestos filter, owing, in some cases, to the very fine state of division of the cuprous oxide, and in others to the simultaneous precipitation of some of the copper in the form of cuprous hydroxide. In such cases, the author finds that good results are obtained with a filter prepared by placing an ash-free filter paper in a funnel and treating it first with yellow ammonium sulphide solution, and then for five minutes with dilute sulphuric acid (1 : 2) ; by this means, the pores of the paper are charged with a layer of finely divided sulphur, which always gives a clear filtrate after the first few drops of the liquid have passed through it. After washing, the filter and precipitate are dried in the oven, the precipitate being then removed as far as possible to a weighed platinum crucible, the filter burnt and the ash also placed in the crucible ; the precipitate is then heated to redness in a current of hydrogen for a quarter of an hour, and, after cooling, weighed. The weight of cuprous sulphide thus obtained, multiplied by 0.7987, gives the corresponding quantity of copper, from which the amount of dextrose is given by means of Allihn's tables. It is found



that the warm Fehling's solution has a negligible action on the sulphur and the small quantity of ammonium sulphide held by the filter paper. A series of comparative estimations of the dextrose in urines, using sulphur filters and ordinary asbestos filters, shows that the former, although they act rather more slowly than the latter, give almost theoretical results, whilst when asbestos is employed, very low values are obtained.

T. H. P.

**Reaction for Mannitol.** By HENDRIK WEFERS BETTINK (*Ned. Tijdschr. Pharm.*, 1901, 13, 321–322).—0.01 gram of the substance is dissolved in 1 c.c. of dilute sulphuric acid, 3 drops of a solution of potassium dichromate (1 : 25) are added, and the mixture boiled for 1 minute. The solution is then made slightly alkaline with sodium hydroxide, filtered, and boiled with 1 c.c. of Fehling's solution. On oxidation, mannitol is converted into the corresponding aldehyde, *d*-mannose, which has a strong cupric reducing power.

It is, of course, necessary first to ascertain whether the mannitol contains any added reducing substances or sucrose; the presence of the latter may be detected by the gradual formation of a brown coloration when 0.05 gram of the substance is dissolved in 3 c.c. of sulphuric acid to which 1 drop of water is then added; pure mannitol remains practically unchanged for a few hours.

L. DE K.

**Estimation of Volatile Acids in Wine.** By J. DUGAST (*Ann. Chim. anal.*, 1902, 7, 19).—A reply to Curtel (this vol., ii, 55). The author states that the estimation of the volatile acidity by taking the difference between the total and fixed acidity is not more correct than the direct estimation of the acidity in the distillate.

The fixed acids, acting on the acetates, expel acetic acid, but the result is not consequently too low; exact compensation takes place. The slight error due to the presence of ethyl acetate may in most cases be overlooked. In practice, both methods give identical results.

L. DE K.

**Distinction between Ferric Citrate and Ferric Potassium Tartrate.** By PAOLO FIORA (*Chem. Centr.*, 1901, 11, 1322; from *Boll. Chim. Farm.*, 40, 696).—A few drops of a solution of silver nitrate (1 : 10) are added to a few c.c. of a highly diluted solution of the salt to be tested. If a precipitate is at once formed which disappears on shaking, the solution contains ferric citrate, whilst in the case of the tartrate the precipitate gradually increases. In the dark, the citrate solution remains unchanged, but the tartrate solution gradually blackens owing to reduced metallic silver.

L. DE K.

**Two New Methods for the Estimation of Berberine.** By HARRY M. GORDIN (*Arch. Pharm.*, 1901, 239, 638–645).—From a solution of berberine or any of its salts in absolute alcohol, the alkaloid can be precipitated by alcoholic sulphuric acid as the sulphate  $C_{20}H_{17}O_4N.H_2SO_4$ ; the mixture should be diluted with an equal volume of ether, allowed to remain overnight, and the precipitate filtered and washed with a mixture of equal volumes of alcohol and

ether, the total volume of the filtrate and washings being noted. The precipitate is rinsed into a 200 c.c. graduated flask, 20 c.c. of 20 per cent. potassium iodide solution added, and then water to the mark, and the whole well shaken; berberine hydriodide,  $C_{20}H_{17}O_4N, HI$ , is precipitated, one equivalent of free acid remaining in solution for each molecule of berberine present. The liquid is filtered, and 100 c.c. of the filtrate are titrated with  $N/40$  potassium hydroxide, phenolphthalein being used as the indicator. The alkali should be standardised against  $N/40$  sulphuric acid under similar conditions, the alkaloid being omitted, of course; 1 c.c. of  $N/40$  alkali, used in titrating half of the solution = 0.01675 gram of berberine in the quantity taken, and 0.0000526 must be added for each c.c. of mother liquor and washing liquid used, on account of the solubility of berberine sulphate in a mixture of alcohol and ether.

If it is not a solution in absolute alcohol which has to be dealt with, the berberine should be precipitated with excess of 10 per cent. potassium iodide solution, the precipitated hydriodide washed with 2 per cent. potassium iodide solution and rinsed with a little water into a flask, heated at 60—70°, acetone added in volume equal to one-third of that of the water, the flask corked loosely and shaken for 10 minutes, 5 c.c. of 10 per cent. sodium hydroxide solution added, the shaking continued for 10 minutes or so until the yellow hydriodide has disappeared, or the flask warmed at 50—60° if necessary to that end; water added to the cooled contents until the acetone present amounts to one-ninth of the whole in volume, the flask allowed to remain overnight, the acetoneberberine filtered off, dried first under diminished pressure and then at 105°, and weighed. One gram of acetoneberberine = 0.853 berberine; and 0.0000273 must be added for each c.c. of the dilute acetone mother liquor, to allow for the solubility of the acetoneberberine therein. C. F. B.

**Estimation of Pepsin in Gastric Juice.** By LÉON MEUNIER (*J. Pharm. Chim.*, 1901, [vi], 14, 555—557. Compare Abstr., 1901, ii, 342).—One gram of casein and 0.5 c.c. of pure hydrochloric acid are added to 14 c.c. of the gastric juice and the whole vigorously shaken. After the casein has settled to the bottom of the vessel, the amount of free hydrochloric acid is estimated in a portion of the clear liquid. The remainder is then heated at 40° for 24 hours and the free hydrochloric acid again estimated. The difference between these two numbers gives the pepsin value of the gastric juice. H. R. LE S.

**Testing Albuminous Urines.** By L. PORTES and A. DESMOULIÈRES (*Ann. Chim. anal.*, 1901, 6, 442—443).—A useful tabular scheme for testing urines for nucleoalbumins, mucin, globulin, albumins soluble in acetic acid, serin, albumoses, and peptones according to recognised methods. L. DE K.

## General and Physical Chemistry.

**Some Phenomena connected with the Combination of Hydrogen and Chlorine under the Influence of Light.** By P. V. BEVAN (*Proc. Camb. Phil. Soc.*, 1902, 11, 264—266).—Using an apparatus essentially the same as that of Bunsen and Roscoe, the author has studied the connection between the initial expansion, the accompanying rise of temperature, and the amount of hydrogen chloride formed when a mixture of hydrogen and chlorine is exposed to light. It is shown that the initial expansion occurs only when the hydrogen and chlorine combine and is due to the heat liberated by the combination. The author's results differ from Pringsheim's (*Ann. Phys. Chem.*, 1887, 32, [iii], 384). J. C. P.

**Quantitative Spectra of Beryllium.** By W. NOEL HARTLEY (*Proc. Roy. Soc.*, 1902, 69, 283—285).—Solutions of beryllium salts of diminishing concentration have been spectroscopically examined and the gradual extinction of the characteristic lines has been noted. Two lines,  $\lambda$  3130.3 and 2478.1, are still visible when the concentration of the beryllium has fallen as low as 0.000001 per cent. J. C. P.

**Dispersion of the Magnetic Rotation of the Plane of Polarisation in Negatively Rotating Salt Solutions. II. Further Measurements with Potassium Ferricyanide.** By L. H. SIERTSEMA (*Proc. K. Akad. Wetensch. Amsterdam*, 1901, 4, 339—341).—For potassium ferricyanide there appears to be no distinct variation of the rotation constant with the concentration. J. C. P.

**Attempt at a Theory of Phosphorescence of Long Duration, especially of the Sulphides of the Alkaline Earths.** By L. E. O. DE VISSER (*Rec. Trav. Chim.*, 1901, 20, 435—456).—Pure barium sulphide, prepared from barium carbonate and sulphur, does not phosphoresce; traces of bismuth induce phosphorescence, a maximum being reached when the proportion of bismuth to barium is as 2 atoms to 100,000 atoms. Similarly, the phosphorescence of calcium sulphide decreases with the purity of the substance.

At the ordinary temperature, phosphorescence is recognisable one month after the exposure to light; at a low temperature, the phosphorescence is less obvious, but remains for a longer period, whilst at a higher temperature the reverse is the case. The author discusses the interpretation of these phenomena. K. J. P. O.

**Chemical Action of the Cathode Rays.** By GERHARD C. SCHMIDT (*Ann. Physik*, 1902, [iv], 7, 321—332).—When ferric and mercuric chlorides are exposed to the action of the cathode rays, reduction takes place in both cases, as can be shown by testing with ferricyanide and ammonia respectively; in like manner, silver and mercurous chlorides darken on exposure to the cathode rays, owing in

the first case to the formation of a subchloride. The colour changes shown by sodium and potassium chlorides when subjected to the action of the cathode discharge are attributed to the formation of subchloride, and the grounds for this conclusion (see Wiedemann and Schmidt, *Abstr.*, 1898, ii, 291) have been confirmed. In interpreting the action of the cathode rays in the above cases, the author considers that the negatively charged electrons satisfy the positive valency of the metal, which is then no longer able to retain the whole of the acid radicle; the latter, if volatile, escapes. In cases, such as mercuric, barium, and strontium sulphates, where the acid radicle is not volatile, the cathode rays probably cause a dissociation into ions, and only eventually a slight reduction.

J. C. P.

**Some Properties of the Radiations from Radio-active Substances.** By HENRI BECQUEREL (*Compt. rend.*, 1902, 134, 208—211).—It has been previously shown that the radiations emitted by radium partly consist of those which are deflected in a magnetic field, partly of radiations not deflected, which are further divisible into those easily absorbed and those very penetrative. The radiations emitted by uranium had been previously shown to contain deviable rays (*Abstr.* 1900, ii, 518); further work has failed to detect any of the other, that is, the non-deviable rays, but it does not prove the entire absence of at least the penetrative rays, the action of which on a photographic plate is exceedingly slow. The radiations are also found to chiefly consist of those of radium which are least deviated. The rays which are deflected are shown to be those which are most active in effecting the transformation of white phosphorus into red, whilst the penetrative non-deviated rays have no appreciable action. It is probable that those rays, non-deviated but easily absorbed, would also be active in this respect, but the conditions of the experiment precluded their activity being rendered evident (this vol., ii, 57).

L. M. J.

**Theory of Oxidation and Reduction Elements.** By CARL FREDENHAGEN (*Zeit. anorg. Chem.*, 1902, 29, 396—458).—Assuming with Ostwald that oxidation consists in increasing the positive or diminishing the negative charge, then all cells may be classed together as oxidation elements. The chemical activity of the cells may be due to actions of the three types: (1)  $\text{Cu} + \oplus = \text{Cu}^{++}$ , (2)  $\text{Fe} + \oplus = \text{Fe}^{+++}$ , and (3) formation of new ions from a complex ion. The author has studied cells belonging to the second type. Peters' results (*Abstr.*, 1898, ii, 419) on the potential in a solution containing ferrous and ferric ions have been confirmed, and the formula which he developed is found to be correct. Experiments made with cuprous and cupric, stannous and stannic, manganate and permanganate, and sulphate and persulphate solutions also prove the validity of Peters' formula.

Platinum electrodes in some oxidising solutions show a constant potential immediately after immersion, whilst in others it is variable, and this indicates that the velocity of reaction of the ions of the oxidising solution with the gases absorbed by the platinum is very variable. It has been established that in oxidation elements the



platinum electrodes always become charged with gases ; in some cases, the potential measured is entirely due to this gas charge, and is in no way conditioned by the giving up of electron from the ion of the solution to the electrode. The magnitude of the gas charge is dependent on the hydrogen ion concentration in the liquid, but the potential of the oxidising agent is absolutely independent of this.

Potential difference measurements with mixed acid or alkaline solutions of potassium ferrocyanide and ferricyanide give results which show deviations from Peters' formula.

The conditions for the existence of ions in aqueous solution are discussed, and it is shown that when the electrolytic potential is smaller than  $-1.08$ , the higher stage of oxidation of a substance is only stable when the concentration is less than normal in normal acid solution. When the electrolytic potential is greater than  $0$ , the lower stage of oxidation of an ion is not stable in normal concentration in normal acid solution.

In an electromotive respect, an ion is inactive when neither a higher nor a lower stage of oxidation of it is capable of existing in the solution in appreciable quantity.

Using platinum electrodes, the potential measured in hydrogen peroxide solutions is not due to the oxidising action of the substance but to secondary causes. Hydrogen peroxide is to be regarded in this respect as a peracid ; its oxidising power is due to the change of  $(\bar{O}-\bar{O})$  into  $2\bar{O}$ , its reducing power to the change of  $(\bar{O}-\bar{O})$  into  $O_2$ .  
J. McC.

**The Nitrogen-Hydrogen Gas Element.** By E. BAUR (*Zeit. anorg. Chem.*, 1902, 29, 305—325).—The *E.M.F.* of the element has been determined, the gases being contained over ammonia which contains  $N'''$  and  $H^+$  ions. Liquid ammonia was found to be inconvenient, and the liquids used were Divers' fluid (ammonium nitrate saturated with ammonia) and saturated aqueous ammonia. The most constant results were obtained when the former electrolyte was employed. The *E.M.F.* is  $0.590$  volt at  $-10^\circ$ . The *E.M.F.* sinks rapidly when current is drawn from the cell, but regains its normal value on standing, and this indicates that the current is produced by the union of nitrogen and hydrogen to form ammonia.

The decomposition tension of the two electrolytes has been determined by the methods of Glaser (*Abstr.*, 1899, ii, 78) and Bose (*Abstr.*, 1899, ii, 348). There is an evident break in the curves obtained, but on account of the small concentration of the ions in the liquid, the point is not particularly sharp.

Unsuccessful attempts were made to combine nitrogen and hydrogen directly over platinum black and over chromium nitride ; no ammonia was produced.  
J. McC.

**Variation of Electromotive Force and of the Temperature Coefficient of the Daniell Cell with the Concentration of the Sulphate of Zinc.** By J. CHAUDIER (*Compt. rend.*, 1902, 34, 277—279).—The *E.M.F.* of a Daniell cell was determined when the concentration of the zinc sulphate varied from  $0$  to  $200$  per  $100$  of water, and the temperature

coefficient was found at each concentration, the solution of copper sulphate being saturated throughout. It was ascertained that with increasing concentration of the zinc sulphate, the *E.M.F.* at first increases, reaching a maximum of 1.1368 when the concentration of the zinc sulphate is 0.5 after which it decreases, being 1.0902 for the saturated solution. The temperature coefficient is negative for the low concentrations, becomes positive at about 0.5 per cent., and again negative at from 7 to 8 per cent. When the concentration of the zinc sulphate is either of these values, the *E.M.F.* of the Daniell cell is independent of temperature. It also follows that the variation of the heat of the reaction with dilution varies in a corresponding way.

L. M. J.

**Current and Energy Efficiencies obtainable in the Electrolytic Preparation of Alkali Hypochlorites and Chlorates.** By FRITZ FOERSTER and ERICH MÜLLER (*Zeit. Elektrochem.*, 1902, 8, 8—17).—By the use of a platinum anode coated with platinum black, and by the addition of a chromate to the alkali chloride solution, the current efficiency in the electrolytic preparation of alkali hypochlorites may be made almost equal to the theoretical value. By employing a small current density, the *E.M.F.* required may also be made to approach very closely to the theoretical 2.2 volts. For example, the authors obtained a 96 per cent. current efficiency using an *E.M.F.* of 2.4 volts.

The current efficiency in the preparation of chlorates may be raised to nearly 95 per cent., by adding to the electrolyte quantities of hydrochloric acid sufficient to maintain the ratio of hypochlorous acid to hypochlorite between the limits 2:1 and 1:2. The presence of a chromate is necessary in this case also. These results confirm Foerster's theory of the formation of chlorate (*Abstr.*, 1899, ii, 278, and 1900, ii, 72).

T. E.

**Electro-affinity as a Basis for the Systematisation of Inorganic Compounds.** By JAMES LOCKE (*Amer. Chem. J.*, 1902, 27, 105—117).—The author discusses Abegg and Bodländer's theory (*Abstr.*, 1899, ii, 542) in its connection with the solubility of salts, formation of complexes, and stability on ignition. It is shown that the behaviour of thallium salts is not in conformity with what is to be expected, according to the theory, from the decomposition voltage of thallium. The general behaviour of cuprous, barium, zinc, and caesium salts does not agree with the predictions of the theory, and the solubility relationships of many alums (*Abstr.*, 1901, ii, 656) are directly opposed to it. The author thinks that little useful purpose is served by Abegg and Bodländer's speculations.

J. McC.

**Spontaneous Ionisation of Gases.** By C. T. R. WILSON (*Proc. Roy. Soc.*, 1902, 69, 277—282).—This continuation of previous work (*Abstr.*, 1901, ii, 435) deals with the ionisation of air, hydrogen, carbon dioxide, sulphur dioxide, and chloroform vapour. As before, the rate of leak from a charged conductor is found to be proportional to the pressure, except for high values of the latter. The rates of

production of ions in air, carbon dioxide, sulphur dioxide, and chloroform vapour (hydrogen is an exception) are very nearly in the ratio of the densities of the gases. In noting the similarity of these results to those obtained by Strutt (*Phil. Trans.*, 1899, 196, A, 507), when the above gases were exposed to the action of radium and polonium rays, the author suggests that the ionisation may be due to radiation from the walls of the vessel.

J. C. P.

**Measure of the Electrolytic Diffusion, Transport Numbers, and Mobility of the Ions.** I. By PAOLO STRANEO (*Atti R. Accad. Lincei*, 1902, [v], 11, i, 58—65).—The author brings forward a method for measuring the coefficient of diffusion,  $D$ , the transport number  $n$ , and the relative mobilities,  $u$  and  $v$ , of the ions of an electrolyte, which obviates the use of diaphragms and requires only very small differences of concentration, besides being very rapidly carried out.

The principle of the method is to place the electrolyte to be examined between two horizontal electrodes at a short distance apart, and by means of an electric current of convenient density to cause a displacement of the electrolyte from the top to the bottom; from the variations of the concentration of the electrolyte in the neighbourhood of the electrodes, the values of  $D$ ,  $n$ ,  $u$ , and  $v$  can be calculated. A description of the apparatus is given, and also the mathematical reasoning required for the calculations. A test experiment with zinc sulphate solution between amalgamated zinc electrodes gave good results.

T. H. P.

**Measurement of Ionic Velocities in Aqueous Solution, and the Existence of Complex Ions.** By BERTRAM D. STEELE (*Phil. Trans.*, 1901, 198, A, 105—145).—Details are given of work previously published (*Trans.*, 1901, 79, 414), and the results of further experiments are recorded. The following new indicators have been used; as cation indicators, magnesium chloride with magnesium oxide suspended in the solution, potassium chloride containing dissolved potassium carbonate, silver nitrate with silver anode, aluminium sulphate with aluminium hydroxide suspended in the solution; as anion indicator, potassium fluoride, containing a small quantity of acetic acid. The new transport numbers recorded in this paper are chiefly those of salts like barium chloride and magnesium sulphate. It is found that in these cases, which deviate from the simplest type, (1) the transport number is not independent of the concentration; (2) the specific ionic velocity of the cathion varies with the particular salt studied; (3) the current as measured by the galvanometer is not the same as that calculated from the observed velocity of the margin. The explanation that the specific ionic velocity varies with the concentration, and varies more for some ions than for others, does not commend itself to the author, and he prefers to attribute the exceptional behaviour of such salts to the formation of complex ions in solution (compare Noyes, *Abstr.*, 1901, ii, 143). This means a motion of at least a portion of the undissociated salt along with the ions, and consequently the concentration of the solution within the margin may be

altered; this interferes with the regularity of the potential fall, and the velocity of the margin is correspondingly affected. Experimental evidence of such changes of concentration within the margin is recorded in the paper.

J. C. P.

**Melting of Dissociating Compounds.** By FRANK AUSTIN LIDBURY (*Zeit. physikal. Chem.*, 1902, 39, 453—467).—It has been shown by Roozeboom that many hydrates may at the same temperature be in equilibrium with solutions containing respectively more or less water than the hydrate itself (*Abstr.*, 1893, ii, 119). According to the expression deduced by Roozeboom, the temperature-concentration curve of the solution in equilibrium with the hydrate should be perfectly continuous with a maximum corresponding with the melting point of the hydrate. This result, however, was not confirmed by his own experiments in the case of the hexahydrate of calcium chloride, or by the determinations of Le Chatelier. The author has therefore carefully redetermined the temperature-concentration curve of solutions in equilibrium with  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$  for solutions of composition varying from  $\text{CaCl}_2 \cdot 5.54\text{H}_2\text{O}$  to  $\text{CaCl}_2 \cdot 6.44\text{H}_2\text{O}$ . He finds the curve is perfectly continuous with a maximum at  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ . Similar results were also obtained for the equilibrium of the solid compound of aniline and phenol with the liquid mixture, the results, however, not possessing so high a degree of accuracy. The variation of crystallisation velocity for  $10^\circ$  of undercooling was also determined in the calcium chloride system, and it was found to increase continually with addition of water. In the case of sulphuric acid, however; the addition of small quantities of either sulphur trioxide or water greatly lowers the crystallisation velocity, this behaviour being typical of a compound which does not dissociate, or does so to but a slight extent, during melting.

L. M. J.

**Experimental Researches on the Measurement of Critical Constants.** By PHILIPPE A. GUYE and ED. MALLET (*Arch. Sci. phys. nat.*, 1902, 13, 30—40; 129—143).—The papers form the first two of a series, the first is largely historical and deals with the views of various authors on the state of matter under the critical conditions. The authors consider it established that the two states become identical at the critical temperature, above which only one fluid form exists. The disappearance of the meniscus and formation of the cloud determine the critical temperature, and many of the differences found by previous observers between the two phenomena are due to inequalities of temperature, whilst impurities and also partial decomposition before the critical temperature account for many divergencies. The authors enforce the necessity of having the liquid enclosed in a tube the capacity of which is equal to the volume at the critical point of the quantity employed. In the second paper, the authors give an account of the method and apparatus employed in their determinations. For the determination of the critical temperature and pressure, the methods employed by Altschul were used (*Zeit. physikal. Chem.*, 1893, 11, 577) and various sets of experiments are given in order to show the trustworthiness of the apparatus. As tests of the purity of the compounds, the indices



of refraction and the viscosity coefficients were determined. The results are postponed to later communications. L. M. J.

**Critical Constants and Molecular Complexity of some Organic Compounds.** By PHILIPPE A. GUYE and ED. MALLET (*Compt. rend.*, 1902, 34, 168—171).—The following results have been obtained in continuation of those previously recorded (this vol., ii, 195). The tables contain the values of the critical constants and of the ratios which serve as the criteria of complexity (*loc. cit.*):

Compound.	$T_c$ .	$P_c$ .	$K_c$ .	$MR/K_c$ .	$D_c/D$ .	$f$ .
Anisole .....	641·5	41·25	15·55	2·03	3·91	3·19
Phenetole .....	647·0	33·8	19·14	1·89	4·14	3·32
<i>m</i> -Cresol .....	705·0	45·0	15·67	2·01	4·11	3·40
Aniline .....	698·8	52·4	13·34	2·17	4·00	3·22
Dimethylaniline .....	687·7	35·6	19·32	2·00	4·16	3·26
Dimethyl- <i>o</i> -toluidine .....	667·8	30·8	21·68	1·97	4·08	3·24

None of these compounds therefore show appreciable polymerisation above the boiling point.

Acetonitrile .....	543·2	47·7	11·39	0·95	5·93	3·15
Propionitrile .....	558·7	41·3	13·53	1·14	5·22	3·16
Butyronitrile .....	582·1	37·4	15·56	1·28	4·86	3·17
Hexonitrile .....	621·8	32·1	19·34	1·50	4·46	3·37
Benzonitrile .....	699·2	41·6	16·81	1·79	4·48	3·16

The nitriles are polymerised at the critical state, the polymerisation decreasing as the series is ascended. It is very marked for acetonitrile, being greater than for acetic acid. L. M. J.

**Vapour Pressure in the System, Water-Acetone-Phenol. I.** By FRANZ A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 1902, 39, 485—510; see Abstr., 1900, ii, 393).—The vapour pressure and composition of the vapour were first determined for the system water—phenol at temperatures between 29·8° and 64·4°. In each case, the concentration of the phenol in the vapour phase is less than that in either of the liquid phases, so that by evaporation at any temperature the more aqueous liquid phase would finally disappear. In the system water—acetone, two liquid phases are not obtained and the vapour pressure was determined for solutions containing 8·04, 15·6, and 82·9 per cent. of acetone, whilst tables are also given for the vapour pressure of mixtures of various concentrations at 50°, 56·5°, 68°, and 75°. A diagram showing the form of the binodal curve in the ternary system is given, and the composition determined for a number of conjugate solutions. It is seen that the concentration of phenol in the more aqueous phase is lowered by the substitution of acetone for water, whilst in the other phase the concentration of phenol is at first in

creased and afterwards lowered. The critical temperature in the ternary system is  $92^{\circ}$ , above which but one liquid phase is obtainable. A large number of determinations of the vapour pressure in the ternary system were made and tables are given. Diagrams show how the pressure decreases in various acetone—water mixtures when phenol is added. It is noteworthy that of equally concentrated solutions of phenol in water and acetone, the vapour pressure of the aqueous solution is the smaller if the concentration of phenol is below 73 per cent. and *vice versa*.

L. M. J.

**Researches on Boyle's Law at Low Pressures.** By ANGELO BATTELLI (*Ann. Chim. Phys.*, 1902, [vii], 25, 308—365).—A detailed account of experiments made on the compressibility of hydrogen, oxygen, and carbon dioxide under low pressures, the results of which are summarised in the following conclusions.

Hydrogen obeys Boyle's law under pressures varying from 760 to 0.02 mm. Oxygen deviates from the law under 0.7 mm. pressure, becoming more compressible; this effect may be due to the diminution in the number of reacting molecules owing to the formation of molecular groups. A slight deviation is also noticed in the case of air between the limits of 2 mm. and 5 mm. pressure.

The compressibility of carbon dioxide under low pressures is greater than its value calculated from the law, but this is probably due to the absorption of the gas by the walls of the containing vessels, the deviation from theory being greater in glass than in iron cylinders. If these variations in compressibility are due to cohesion, then the equation of van der Waals must be replaced by the expression  $[p + \phi(a.v.T)](v - b) = k$  where  $\phi(a.v.T)$  is a function which becomes discontinuous for one or more values of  $v$ . This communication also contains a detailed criticism of the results of earlier investigators.

G. T. M.

**True Density of Chemical Compounds and its Relation to Composition and Constitution. V. Nitrogen Compounds.** By INNOCENTIUS I. KANONNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1901, 33, 743—790. Compare Abstr., 1900, ii, 134, and 1901, ii, 305).—The author has determined the true densities of nearly 300 nitrogen compounds, and from his results draws the following conclusions: (1) The molecular density of nitrogen in the free state is 89.0, but it only has this value in comparatively few of its compounds, namely, nitric acid, methyl nitrate, ethylene nitrate, glyceryl nitrate, the oxalazines, nitric oxide, and nitrogen peroxide. In its other compounds, nitrogen possesses molecular densities depending on, and varying with, its valency. Thus, for tervalent nitrogen, the molecular density has the value 56.6; for quinquevalent, 45.0; and for septavalent, 33.4. Change of valency of a nitrogen atom in a compound is usually accompanied by a disappearance of double bonds between carbon atoms. (2) Nitrogen entering a closed ring of carbon atoms exerts no influence on the increase produced by such a ring on the molecular density of the compound, namely, 8.7. (3) Double, and, in general, more complex, linkings between nitrogen atoms and between nitrogen and carbon have

no influence on the magnitude of the molecular density. (4) A double linking between an atom of nitrogen and one of oxygen influences the molecular density to the same extent as a double linking between carbon and oxygen, which causes an increase of 4.84. (5) The grouping  $\begin{smallmatrix} \text{N} \\ \text{C} \end{smallmatrix} > \text{O}$  or  $\begin{smallmatrix} \text{N} \\ \text{N} \end{smallmatrix} > \text{O}$ , produces the same change in the molecular density of a compound containing it as does the grouping  $\begin{smallmatrix} \text{C} \\ \text{C} \end{smallmatrix} > \text{O}$ , that is, the value is diminished by 7.74.

T. H. P.

**Molecular Surface Energy of Solutions. Molecular Weight of Sulphur.** By DESIDERIUS PEKÁR (*Zeit. physikal. Chem.*, 1902, 39, 433—452).—The method for the determination of the surface tensions is described; it consists essentially in the comparison of the curvature of the liquid contained in a narrow vessel with that of a liquid of known surface tension. The molecular surface energy was determined in the case of ethyl ether, carbon disulphide, and benzene. The values of the critical temperatures [that is, the temperatures at which  $\gamma(Mv)^{\frac{2}{3}} = 0$ ] for the compounds were found to be respectively, 187.7°, 271.0°, and 274°, whilst the mean temperature coefficients are 0.230, 0.203, 0.233, indicating non-associated liquids (these numbers are not expressed in the same units, and are not directly comparable with those of Ramsay and Shields). In the case of mixtures of these compounds, although the molecular surface energy itself may not be the additive mean, yet the temperature coefficient is still normal, and hence, if the molecular weight of one component of a mixture is known, that of the other is calculable. This result is in accord with that of Ramsay and Aston (*Abstr.*, 1895, ii, 40), with which work, however, the author was not familiar until the end of his research. The molecular weight of sulphur was then ascertained by means of the determination of the molecular surface energy of its solution in carbon disulphide and in disulphur dichloride. In both solvents, it was found that the dissolved sulphur has a molecular weight corresponding with  $S_6$  or  $S_8$ , a result in accord with most determinations, but not with those of Orndorff and Terrasse, who, by the cryoscopic method, obtained the value 61.9 for the molecular weight of sulphur in disulphur dichloride solution (*Abstr.*, 1896, ii, 358).

L. M. J.

**Liquid Sulphur Dioxide as a Solvent.** By PAUL WALDEN and M. CENTNERSZWER (*Zeit. physikal. Chem.*, 1902, 39, 513—596. Compare *Abstr.*, 1900, ii, 10).—The conductivity of pure liquid sulphur dioxide at 0° is  $0.9 \times 10^{-7}$  (recip. Siemens' units). This is somewhat greater than the conductivity of water and less than that of liquid ammonia. It is probable that the conductivity is due to a slight dissociation into  $SO''$  and  $O''$ , and further into  $S''''$  and  $2O''$ . The existence of the ion  $S''''$  is suggested by the proved formation of  $Te''''$  in fused tellurium tetrachloride (Hampe), which is a good conductor. The conductivity of solutions of the following salts in liquid sulphur dioxide have been determined at dilutions from  $v=8$  to  $v=2048$ ; potassium iodide, bromide, and thiocyanate, sodium iodide, ammonium iodide, and thiocyanate, rubidium iodide, methylammonium chloride, dimethylammon-

ium chloride, trimethylammonium chloride, tetramethylammonium chloride, bromide, and iodide, ethylammonium chloride, diethylammonium chloride, triethylammonium chloride, tetraethylammonium chloride, benzylammonium chloride, and trimethylsulphonium iodide. The molecular conductivities of the univalent haloids in sulphur dioxide vary from 3 to 157 at 25°. Some of the salts have a considerably higher conductivity in sulphur dioxide than in water at the same concentration. Kohlrausch's law of the independent migration of the ions seems to apply, but an additive scheme could not be satisfactorily constructed, because in most cases the maximum conductivity had not been reached when  $v = 2048$ . The results obtained are not in conformity with Ostwald's dilution law, and only for some of the salts are the modified formulæ of Rudolphi and van't Hoff valid. Of the inorganic iodides, the rubidium salt is the best conductor, then follow potassium, ammonium, and sodium. Tertiary substituted ammonium salts are better conductors than secondary, and these again conduct better than primary; there is a large change on passing from a tertiary to a quaternary ammonium salt. Salts with isomeric cations have not the same conductivity.

Iodine, mercuric iodide, and cadmium iodide dissolve more readily in solutions of potassium iodide and rubidium iodide than in the pure solvent, and this proves that formation of complexes takes place. The solutions of the complex compounds conduct better than those of the substance from which they are produced.

The conductivities of the solutions have been determined at temperatures from about  $-67^{\circ}$  upwards. The conductivity at first increases to a maximum and then falls. When certain solutions are heated, separation of solid or decomposition takes place, but others can be heated up to and even beyond the critical point and an apparently homogeneous solution remains. The conductivities of the latter have been determined up to the critical point (hydrochloric acid, quinoline, triamylammonium iodide, benzylammonium chloride, and trimethylsulphonium iodide). The conductivity continuously decreases as the temperature rises, and in all cases disappears at the critical point. The authors conclude from this that electrolytic dissociation is associated with the liquid condition; they show that there is a parallelism between dissociating power and surface tension of a number of solvents (both of these become zero at the critical point); and they discuss the connection between dissociating power and dielectric constant, medial energy, latent heat of vaporisation, and the association factor of the solvent.

Using the Walker and Lumsden modification of the Landsberger method, the rise in boiling point of the sulphur dioxide due to dissolved substance has been determined. The latent heat of vaporisation of sulphur dioxide, obtained from the vapour tension curve, is 92.45, and by direct experiment 91.7 and 91.2 have been found. Using the mean value, the molecular rise of boiling point 15.0 is obtained by van't Hoff's formula. Non-electrolytes (toluene, acetanilide, naphthalene, diisobutyl tartrate, and  $\beta$ -naphthol picrate), gave normal values for the molecular weight. The values obtained for electrolytes are, with out exception, abnormal, but not similar to those found in aqueous



solution. The values being too low, the authors are forced to assume that the electrolytes are associated as well as dissociated in sulphur dioxide solution. The salts can be divided into two groups, one in which the value of  $i$  is greater than 1 (up to 1.3), and another where the value of  $i$  is less than 1. As the dilution increases, the value of  $i$  diminishes in the former case and increases in the latter, so as to converge towards 1 in all cases at high dilution. On account of the degree of polymerisation being unknown, it is not possible to calculate the degree of dissociation from the  $i$  values; the degree of dissociation as calculated from the conductivity is also complicated by the association. The authors think it probable that association takes place both between dissolved molecules themselves, and between these and solvent molecules.

J. McC.

**Absorption of Gas in Organic Solvents and in their Solutions.** By G. LEVI (*Gazzetta*, 1901, 31, ii, 513—541).—The author's determinations of the solubility of gases were carried out by means of a somewhat modified form of the apparatus described in Ostwald's *Lehrbuch allegem. Chem.*, 2nd Ed., 1, 615. From measurements of the solubilities of oxygen, methane, and ethylene at various temperatures in methyl alcohol and acetone, the following conclusions are drawn: (1) Methyl alcohol and acetone have almost equal solvent powers for gases. (2) With increase of temperature, the solubility decreases regularly according to the general law of gaseous absorption.

Further, determinations of the solubility of nitrogen in methyl alcohol and in methyl alcoholic solutions of potassium iodide and carbamide at various temperature lead to the following deductions: (1) Jahn's empirical law,  $(\alpha - \alpha_1)/M^3 = \text{a constant}$ , found to hold exactly for aqueous solutions of electrolytes, and less so for aqueous non-electrolytes, holds also for the solutions employed by the author; the law must here be expressed by  $(l - l_1)/M^3 = \text{a constant}$  where  $l$  and  $l_1$  are the solubilities of the gas in the pure solvent and in the solution at the same temperature and  $M$  is the number of gram-mols. of the substance in unit volume of the solution. The law  $C_1/C_2 = 1$ , arrived at theoretically by Jahn, holds, in the case of methyl alcoholic solutions, very well for solutions of non-electrolytes and not quite so well for those of electrolytes;  $C_1$  and  $C_2$  here represent the molecular concentrations of the gas in the solvent and the solution respectively.

T. H. P.

**Inorganic Solvent and Ionising Media.** By PAUL WALDEN (*Zeit. anorg. Chem.*, 1902, 29, 371—395. Compare Abstr., 1901, ii, 11).—Arsenic tribromide (melting point  $31^\circ$ ) is a solvent for many salts; its conductivity at  $33^\circ$  is  $\lambda = 1.53 \times 10^{-6}$ . Solutions of antimony triiodide, stannic iodide, ferric chloride, and tetraethylammonium iodide in arsenic tribromide possess only a comparatively small conductivity but sufficient to indicate that ionisation takes place. The value for the molecular depression of the freezing point is 189. Abnormal results have been obtained for the depression of the freezing point with electrolytes, and as these cannot be due to ionisation, it is probable that interaction takes place between the solvent and the

dissolved substance; the abnormality may, however be due to isomorphism of solvent and dissolved substance.

Chlorosulphonic acid ( $\lambda = 0.16 \times 10^{-3}$  at  $25^\circ$ ) has a small ionising power, whilst sulphuric acid ( $\lambda$  about the same as that of  $1/10N$  potassium chloride) and methyl sulphate ( $\lambda = 2.9 \times 10^{-6}$ ) also dissolve salts (both binary and ternary) and the solutions have a comparatively high conductivity.

Comparing the results obtained with those previously found (*loc. cit.*; and this vol., ii, 245) the author concludes that the group  $\text{SO}_2$ : (or  $\text{SO}$ :) has ionising properties and that these are increased by the introduction of hydroxyl groups.

A table is given of various physical properties of inorganic ionising and non-ionising solvents and it is seen that none of the theories so far proposed to account for ionising power can be considered satisfactory.

J. McC.

**Neutral Affinities.** By LEOPOLD SPIEGEL (*Zeit. anorg. Chem.*, 1902, 29, 365—370).—The author conceives that a positive and a negative electron may unite in pairs with a radicle, element, or molecule, and these, balancing each other, are inactive but otherwise the same as the electron associated with the ionic condition. When ammonia,  $\oplus\text{NH}_3\ominus$ , reacts with a positively charged ion and thus gives up its negative electron, the radicle produced has a positive charge and is basic.

The assumption of the existence of these neutral affinities which can be made active by addition to the molecule gives a new signification to Werner's coordination number, and with its aid it may be possible to connect together and explain the nature of double salts, ammonia compounds, oxonium salts, and hydrates.

J. McC.

**Velocity of Solution.** By KARL DRUCKER (*Zeit. anorg. Chem.*, 1902, 29, 459—463. Compare Abstr., 1901, ii, 376).—In reply to Bruner and Tolloczko (this vol., ii, 62; compare also Abstr., 1901, ii, 10), the author points out that the constancy of the value previously obtained by him indicates that no error has been introduced on account of small particles being rubbed off the plate and remaining in suspension in the liquid. The opinion is maintained that the constant in the Noyes and Whitney formula cannot be regarded as a diffusion coefficient.

J. McC.

**Behaviour of Molecular Compounds on Dissolution. II.** By GUIDO BODLÄNDER and R. FITTIG (*Zeit. physikal. Chem.*, 1902, 39, 597—612. Compare Abstr., 1892, 1154).—The authors show that from the solubility of silver chloride in ammonia solution it is unsafe to deduce the exact composition of the dissolved molecular compound, although the results can be used to ascertain whether it is  $(\text{AgCl})_m(m+1)\text{NH}_3$ . From the results with pure solutions of ammonia, it has been found that this formula does represent the molecular compound, but the value of  $m$  could not be calculated. Potassium chloride or silver nitrate in the ammonia solution depresses the solubility of the silver chloride, and from the depressions found it has been

calculated that the molecular compound,  $\text{AgCl} \cdot 2\text{NH}_3$ , is formed in solution. Similar experiments in ammonia solution were made with silver bromide, and it was shown that the corresponding compound,  $\text{AgBr} \cdot 2\text{NH}_3$ , is produced.

The *E.M.F.* of the concentration cells :

Silver | silver chloride in ammonia solution | ammonia solution | silver.

Silver | silver bromide in ammonia solution | ammonia solution | silver

in which the concentration of silver salt and ammonia varied, were determined. From the results obtained, it is proved that the cation present in the solution is  $\text{Ag}(\text{NH}_3)_2$ . The dissociation constant of the complex cation is very small,  $7.88 \times 10^{-8}$ , nevertheless excess of ammonia is required to prevent the dissociation in order that the silver chloride may be completely dissolved.

When equal quantities of 0.1*N* silver nitrate and 0.2*N* ammonia solutions are mixed, then of the silver present only 0.068 per cent. exists in the form of free ions. The electro-affinity (*Abstr.*, 1899, ii, 542) of the silver is considerably increased by the addition of the neutral ammonia molecules.

J. McC.

**Chemical Equilibria between Acid Salts and Sparingly Soluble Salts.** By GAETANO MAGNANINI *Gazzetta*, 1901, 31, ii, 542—549.—[With CARLO GRIMALDI.]—A number of experiments have been made by placing mixtures of different salts and solutions in flasks which were then hermetically closed and shaken in a thermostat until equilibrium was reached, when the contents were examined. The salts employed comprised potassium hydrogen tartrate, potassium hydrogen oxalate, potassium hydrogen sulphate, and calcium sulphate, tartrate and hydrogen phosphate. The experiments are being continued, and will be discussed in a later paper.

T. H. P.

**Barium Sulphate as a Reagent for Colloidal Metallic Solutions.** By LUDWIG VANINO (*Ber.*, 1902, 35, 662—663).—The colour of colloidal solutions of metallic silver or gold, or of arsenious sulphide is at once removed by shaking with barium sulphate; dissolved colouring matters, for example gentianin or magenta, are, however, not eliminated under similar treatment.

W. A. D.

**Nature and Properties of Colloids.** By P. D. ZACHARIAS (*Zeit. physikal. Chem.*, 1902, 39, 468—484).—The paper contains an account of the views of the author regarding colloids and their properties. He considers the colloidal state to be always somewhat unstable and to always tend to the formation of a more stable form, the crystalline. The molecules are in general very great, and probably on this account less amenable to the action of crystallisation forces and more liable to associate and to form great molecular complexes. The absorption of water or other liquid into these complexes eventually results in the formation of a colloidal solution, a labile structure from which the dissolved substance may slowly separate. The formation of such solutions and of jellies is greatly favoured by the membraniform

structure of the molecules. The jelly consists of a molecular network in which microscopic spaces may exist, the seat of many absorption phenomena. He considers that colloids deserve much greater attention than they have hitherto received from chemical investigators.

I. M. J.

**The Nature of Radicles.** By DANIEL VORLÄNDER (*Annalen*, 1902, 320, 99—121).—Numerous examples in recent chemical literature go to show that the electrochemical state of elementary and compound radicles is not constant; it depends on the compound in which the radicles are found and may be either positive or negative.

The supposition that unsaturated radicles always have a negative character leads to much confusion, and is, moreover, opposed to the facts of experiments, for under certain conditions the introduction of unsaturated radicles enhances the basic nature of a compound. The unsaturated groups—phenyl, cyanogen, nitrosyl, and carbonyl are generally compared with the electronegative halogen atoms, but they have a capacity for inducing reaction which is absent in these elementary radicles. The state of saturation of a radicle is an empirical property, quite distinct from the electrochemical condition of the atom or groups of atoms.

A table is given showing that the mobility of hydrogen in certain organic compounds depends on its association with carbon atoms attached to unsaturated radicles; this element is much more firmly held when the carbon atom is combined with saturated radicles of electronegative character. The lability of chlorine and other non-metallic radicles is similarly dependent on the presence of unsaturated groups.

This connection between reactivity and unsaturated character is also noticeable among inorganic substances. Ammonia, which contains two free nitrogen valencies, is more reactive than ammonium chloride. The lower oxy-acids of chlorine, sulphur, and nitrogen are more reactive than the corresponding fully-oxidised compounds. Nitrous and sulphurous acids, for example, are each considered to contain two free valencies, which are satisfied by oxygen in nitric and sulphuric acids. The contrast between the inert character of phosphoric acid and the reactivity of the lower oxy-acids of phosphorus is explained by supposing that phosphorous and hypophosphorous acids possess the symmetrical and dihydroxylic formulæ respectively, and that therefore they each contain tervalent phosphorus with two free valencies.

A different degree of saturation is manifested when a straight chain unsaturated compound changes into a ring system.

The chemical reactivity of a substance may be compared with a change of electricity distributed over the surface of an insulated conductor. When the body is spherical the change is uniformly distributed and is in a comparatively stable condition; this arrangement is analogous with the state of a saturated compound. If the sphere is deformed, or if a portion of its surface is drawn out to a point, the distribution of the charge is altered, the density being greatest at the angular point where the electricity is most readily discharged; this condition



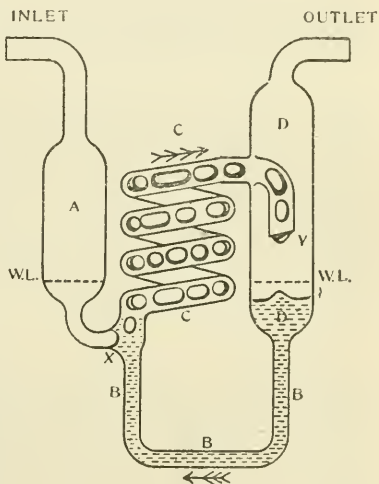
may be compared with that of an unsaturated compound, the points where the electrical density is greatest corresponding with the double linking of the molecule.

A symmetrical distribution of points on the electrified sphere leads to a state of comparatively great stability; this condition may be taken as typical of benzene and its homologues. The symmetrical arrangement being impossible with the di- and tetra-hydrobenzenes, these compounds are very labile and unsaturated. If the quantity of electricity is constant, the density depends on the superficial area of the charged body; a small sphere is more readily discharged than a large one. The electrical analogy supplies an explanation of the fact that polymerides are less reactive than their generators.

The difference of potential of two charged bodies depends on the medium between them, and, in an analogous manner, the reactivity of compounds varies with the solvent employed in carrying out their condensations.

G. T. M.

**Chemical Gas Washing Apparatus.** By C. E. STROMEYER, (*Mem. Manchester Phil. Soc.*, 1902, 46, [viii], 1—3).—The figure shows the form of the apparatus, which was devised for dealing with large quantities of gas and small amounts of absorbing liquid. The liquid is carried along between the gas bubbles through the coil C. The internal diameter of the tube C should be about  $\frac{1}{8}$  inch, and its length about 30 inches.



J. McC.

## Inorganic Chemistry.

**Action of Chromic Acid on Hydrogen Peroxide.** By A. BACH (*Ber.*, 1902, 35, 872—877).—In absence of an acid, chromic acid in aqueous solution liberates the whole of the active oxygen of hydrogen peroxide without being itself affected; when sulphuric acid is present, however, 1 mol. of chromic acid is used for every 2 mols. of hydrogen peroxide present, the action probably taking place according to the equation  $4\text{CrO}_3 + 8\text{H}_2\text{O}_2 + 6\text{H}_2\text{SO}_4 = 2\text{Cr}_2(\text{SO}_4)_3 + 7\text{O}_2 + 14\text{H}_2\text{O}$  (contrast Baumann, *Abstr.*, 1891, 245). Traube's view that the hydrogen of hydrogen peroxide is oxidised to water by

potassium permanganate or silver oxide with liberation of the oxygen of the peroxide cannot be correct, for this would necessitate a reduction of chromic acid in neutral solution, and an interaction  $2\text{CrO}_3 + 3\text{H}_2\text{O}_2 + 3\text{H}_2\text{SO}_4 = \text{Cr}_2(\text{SO}_4)_3 + 3\text{O}_2 + 6\text{H}_2\text{O}$  in acid solution; Berthelot's view of the formation of an unstable hydrogen trioxide is also not in accord with a ratio  $\text{CrO}_3 : \text{H}_2\text{O}_2 = 2 : 1$ . It is more probable that an unstable additive compound of hydrogen peroxide and chromic acid is formed, which decomposes spontaneously in neutral solution with regeneration of chromic acid, although in acid solution a reduction of the latter occurs.

W. A. D.

**Relative Strength of Hydrochloric and Nitric Acids.** By OTTO KÜHLING (*Ber.*, 1902, 35, 678—680).—A reply to the criticisms of Sackur and Bodländer (this vol., ii, 204).

T. M. L.

**Conversion of Orthoperiodic Acid into Normal Periodic Acid.** By ARTHUR B. LAMB (*Amer. Chem. J.*, 1902, 27, 134—138).—When heated at  $100^\circ$  under a pressure of 12 mm. orthoperiodic acid loses water to the extent of 15.62 per cent. This corresponds with the formation of periodic acid of the formula  $\text{HIO}_4$ . The amount of iodine liberated from potassium iodide also shows that  $\text{HIO}_4$  had been produced. By heating to a higher temperature it is not possible to obtain the heptoxide ( $\text{I}_2\text{O}_7$ ), for decomposition takes place with formation of the pentoxide.

J. McC.

**Formation of Ozone by the Electric Discharge.** By ALEXANDRE DE HEMPTINNE (*Bull. Acad. Roy. Belg.*, 1901, 612—621. Compare Abstr., 1898, i, 461).—The author has studied the formation of ozone by means of the electric discharge and finds that the amount of that gas produced varies greatly with the distance of the tin-foil plates from one another, and with their size. It is not proportional to the amount of air passed in a given time, and the pressure has apparently little influence. The intensity of the electrical current has also a very considerable influence on the amount of ozone formed, a current of low potential and high density being more advantageous than one of high potential. For a given value of electrical energy, there will be a given value of those different factors for which the formation of ozone is a maximum. The increase in the amount of ozone by employing oxygen instead of air is not sufficient to justify its use from an economic standpoint.

A. F.

**Physical Chemistry of Sulphuric Acid.** By OTTO SACKUR (*Zeit. Elektrochem.*, 1902, 8, 77—82).—A critical *résumé* of recent papers by Knietzsch (this vol., ii, 132), Schenck (Abstr., 1901, ii, 380), Oddo (Abstr., 1901, ii, 650), and others. In explanation of the fact that sulphuric acid containing 98 per cent. of  $\text{H}_2\text{SO}_4$  absorbs sulphur trioxide better than acid of any other concentration, it is assumed that the equilibrium  $2\text{H}_2\text{SO}_4 \rightleftharpoons \text{H}_2\text{SO}_4 \cdot \text{H}_2\text{O} + \text{SO}_3$  is established in this acid; a stronger acid will contain more free sulphur trioxide, and the partial pressure of this substance in its vapour will be greater; it will therefore absorb it less readily. A weaker acid will contain uncom-

bined water, in contact with which the unimolecular  $\text{SO}_3$  will rapidly polymerise to bimolecular  $\text{S}_2\text{O}_6$ , which is very slowly absorbed by sulphuric acid. The hypothesis also offers a plausible explanation of the peculiarities in the physical properties of this acid. T. E.

**Action of Hydrogen on Sulphides and Selenides.** By HENRI PÉLABON (*Ann. Chim. Phys.*, 1902, [vii], 25, 365—432).—The greater portion of this communication relates to work already published (compare Abstr., 1898, ii, 568; 1899, ii, 24; 1900, ii, 346, 352, 652; 1901, ii, 165, 313, 545, 656). Silver readily attacks hydrogen selenide, and when in excess decomposes it entirely; on the other hand, the action of hydrogen on heated silver selenide is very slight, even at  $620^\circ$  the decomposition is inconsiderable, and after 48 hours the ratio of gaseous hydride to total hydrogen is only 1.01. Hydrogen has a very appreciable action on arsenious selenide,  $\text{As}_2\text{Se}_3$ , even at  $440^\circ$ , and when excess of the selenide is employed the limiting value of the characteristic ratio is 7.9; at  $610^\circ$  this value increases to 13.5. The interaction of hydrogen with mixtures of selenium and arsenic at  $610^\circ$  decreases rapidly as the proportion of the latter metalloid increases. Bismuth selenide,  $\text{BiSe}$ , obtained by fusing together its constituents in equivalent proportions, is slightly decomposed by hydrogen at  $610^\circ$ , but the change is limited by the inverse action; the characteristic ratio is 3.34, but this value rapidly diminishes to zero as the amount of bismuth is increased. The relations between the characteristic ratio and the temperature are indicated by curves. G. T. M.

**Physical Properties of Hydrogen Selenide.** By ROBERT DE FORCRAND and HENRI FONZES-DIACON (*Compt. rend.*, 1902, 134, 171—173. Compare Abstr., 1900, ii, 405).—Hydrogen selenide is liquefied and even solidified by a freezing mixture of carbon dioxide, snow, and methyl chloride; it melts at  $-64^\circ$ , and boils at  $-42^\circ$  under 760 mm. pressure; the sp. gr. of the liquid at its boiling point is 2.12. The solubility coefficients of the gas in water at  $4^\circ$ ,  $9^\circ$ ,  $13.2^\circ$ , and  $22.5^\circ$  are 3.77, 3.43, 3.31 and 2.70 vols. respectively. Pure hydrogen selenide decomposes very slowly; a sample collected over mercury and exposed to light contained only 15 per cent. of hydrogen at the end of seven days. G. T. M.

**Vapour Tensions of Hydrogen Selenide and the Dissociation of its Hydrate.** By ROBERT DE FORCRAND and HENRI FONZES-DIACON (*Compt. rend.*, 1902, 34, 229—231).—The following four points on the vapour pressure curve were determined,  $-42^\circ$ , 1 atms.;  $-30^\circ$ , 1.75 atms.;  $0.2^\circ$ , 4.5 atms.;  $30.8^\circ$ , 12 atms. From these values by Clapeyron's formula, the molecular heat of vaporisation is calculated to be 4740 cal., and hence the Trouton constant is  $4740/231 = 20.5$ , indicating the absence of polymerisation. The hydrate was obtained in the form of colourless crystals, and the following vapour pressures were found:— $0^\circ$ , 346 mm.;  $2.35^\circ$ , 432 mm.;  $3.40^\circ$ , 490 mm.;  $5.40^\circ$ , 597 mm.;  $7.50^\circ$ , 718 mm.;  $14.1^\circ$ , 1.9 atms.;  $22^\circ$ , 5 atms.;  $30^\circ$ , 11 atms. Above  $30^\circ$  the hydrate does not exist. From these values the heat of formation of the solid hydrate is calculated to be 16820 cal. L. M. J.

**Comparison of the Properties of Hydrogen Selenide and Hydrogen Sulphide.** By ROBERT DE FORCRAND and HENRI FONZES-DIAON (*Compt. rend.*, 1902, 134, 281—283. Compare preceding abstract).—Hydrogen sulphide melts at  $-86^{\circ}$  and boils at  $-61^{\circ}$  under 773 mm. pressure. The latter number agrees with Regnault's determination,  $-61.6^{\circ}$  under 760 mm. pressure, but not with Faraday's,  $-73^{\circ}$ .

In the following table, the properties of hydrogen sulphide and hydrogen selenide are compared :

	H <sub>2</sub> S.	H <sub>2</sub> Se.
Boiling point under 760 mm., $T'$ (absolute) .....	211.4°	231°
Critical temperature, $T_c$ (absolute) .....	373.2°	410°
$T/T_c$ .....	0.566	0.564
Critical pressure (in atmospheres).....	92	91
Melting point .....	187°	209°
Density of liquid at boiling point, $D$ .....	0.86	2.12
Molecular volume of liquid, $PM/D$ .....	39.53	38.11
Heat of volatilisation (in calories), $L$ .....	4230	4740
$L/T$ (Trouton's number) .....	20.01	20.52
Heat of formation of hydrate (in calories) .....	16340	16820
Temperature (absolute) at which vapour pressure of hydrate attains 760 mm. ....	273.35°	281°
Solubility in water at $4^{\circ}$ (in volumes) .....	4.04	3.77
"      "      22.5° .....	2.75	2.70

A comparison of the properties of hydrogen sulphide or hydrogen selenide with those of water shows a considerable dissimilarity.

K. J. P. O.

**Atomic Weight of Tellurium.** By ALEXANDER GUTBIER (*Annalen*, 1902, 320, 52—65. Compare Abstr., 1901, ii, 501).—The atomic weight of tellurium is determined by treating an aqueous solution of crystallised telluric acid or a hydrochloric acid solution of tellurium dioxide with hydrazine hydrate, the reduction being performed in an atmosphere of hydrogen. The precipitated tellurium is very readily oxidised ; it is rapidly washed with water and dried by warming in a current of hydrogen. The mean values obtained from telluric acid and tellurium dioxide are 127.34 (3 expts.) and 127.55 (3 expts.) respectively when  $O=16$  ; the constant obtained by estimating the water in crystallised telluric acid is 127.65 (2 expts.). The final result calculated from the three series of experiments is 127.51 (compare this vol., ii, 67, 69). The communication concludes with a criticism of Steiner's method of determining this atomic weight (compare Abstr., 1901, ii, 236).

G. T. M.

**Some Nitrogen Compounds.** By ANGELO ANGELI and FRANCESCO ANGELICO (*Atti R. Accad. Lincei*, 1901, [v], 10, ii, 303—307).—When solutions of hydroxylamine sulphate and of Caro's acid, neutralised with potassium carbonate, are allowed to interact in the cold, the liquid assumes an acid reaction and after a time ceases to reduce Fehling's solution. Also, when treated with aldehydes, the liquid



gives a vigorous reaction for hydroxamic acid, and hence it probably contains the residue,  $\text{NOH}$ , or its hydrate,  $\text{NH}(\text{OH})_2$ .

T. H. P.

**Neutralisation of Phosphoric Acid.** By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1902, [vii], 25, 145—153).—A detailed account of work already published (compare Abstr., 1901, ii, 502).

G. T. M.

**Reactions of two Basic Oxides Exposed Simultaneously to the Action of Phosphoric Acid.** By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1902, [vii], 25, 153—163).—A detailed account of work already published (compare Abstr., 1901, ii, 504).

G. T. M.

**Phosphoric Acid and Chlorides of the Alkaline Earths.** By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1902, [vii], 25, 176—196. Compare Abstr., 1901, ii, 551).—A detailed account of work already published.

G. T. M.

**Simple Apparatus for Demonstrating the Manufacture of Water Gas.** By C. E. WATERS (*Amer. Chem. J.*, 1902, 27, 139—142).—The author describes a simple apparatus in which the "producer" consists of a wide iron tube. This contains a fuse of loosely twisted cotton string round which the coke is packed. The fuse is lighted and oxygen blown in at the bottom until the coke is hot. Superheated steam then enters by a side tube near the bottom of the producer, and water gas issues at the top and may be collected over water.

J. McC.

**Action of some Reagents on Amorphous Silicon.** By PAUL LEBEAU (*Bull. Soc. Chim.*, 1902, [iii], 27, 42—44).—Amorphous silicon, even when finely divided, is not attacked by solutions of cupric chloride, cupric sulphate, cupric chloride and ammonium chloride, cupric chloride and potassium chloride, chromic acid, or nitric acid diluted with its own volume of water (compare Vigouroux, Abstr., 1895, ii, 263), which are the reagents generally employed for acting on cast iron and steel. The absence of silicon from the products of action of these reagents on the latter substances shows that it is present in them in combination and not in the free state.

A. F.

**Heptahydrate of Sodium Sulphate.** By LOUIS C. DE CORPET (*Chem. Centr.*, 1902, i, 397; from *Bull. Soc. Vaud. Sci. nat.*, 1901, 37, 455—462).—The original paper contains a description of experiments which show that the change in the crystalline form of the heptahydrate of sodium sulphate which takes place when the crystals are stirred with the mother liquor and the latter allowed to solidify is not due to the crystallisation of the mother liquor enclosed in the crystals. The crystals of the heptahydrate are destroyed in a few minutes by contact with the smallest quantity of the decahydrate or of the anhydrous salt obtained from it by exposure to the air. The change from

heptahydrate into decahydrate and the anhydrous salt is accompanied by the development of a considerable amount of heat. According to the author, this change is possible at the ordinary temperature although of infrequent occurrence, but at lower temperatures it probably cannot take place except through the agency of the decahydrate. The anhydrous sodium sulphate, obtained by the efflorescence of the heptahydrate, has properties which differ from those of the anhydrous salts already described by the author, hence, including Wyruboff's salts, the anhydrous salt has been prepared in six different forms.

E. W. W.

**Physico-chemical Properties of Sodium Thiosulphate.** By FRANZ FAKTOR (*Chem. Centr.*, 1902, i, 164—165; from *Pharm. Post*, 34, 769—770. Compare this vol., ii, 25).—Determinations of the molecular weight of sodium thiosulphate by the depression of the freezing point of solutions gave 59.92 and 60.5, whilst by the boiling point method the values 78.4, 79.2, and 77.9 were obtained, hence at low temperatures the salt forms the ions  $\text{Na}_2\text{Na}$  and  $\text{S}_2\text{O}_3$ , but at higher temperatures it is decomposed into the ions  $\text{Na}$  and  $\text{NaS}_2\text{O}_3$ . Determinations of the electric conductivity of solutions of sodium thiosulphate of different concentrations also show that ionisation takes place in the stages  $\text{Na}_2\text{NaS}_2\text{O}_3$  and  $\text{Na}_2\text{Na}_2\text{S}_2\text{O}_3$ , and that the salt is hydrolysed in aqueous solutions. The last conclusion is also confirmed by experiments on the inversion of sugar. When electrolysed, sodium thiosulphate forms sulphur, hydrogen sulphide, tetrathionic acid, sulphur dioxide, and sulphuric acid.

E. W. W.

**Formation of Insoluble Phosphates by Double Decomposition: Disodium Phosphate and Silver Nitrate.** By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1902, [vii], 25, 164—176).—An account of work already published (*Abstr.*, 1901, ii, 503).

G. T. M.

**Lithium Antimonide and some other Alloys of Lithium.** By PAUL LEBEAU (*Compt. rend.*, 1902, 134, 231—233).—Lithium and antimony combine directly with great violence, but it was not found possible to obtain a definite compound in this way. If, however, a fused mixture of equal parts of lithium and potassium chlorides is electrolysed with a current of 15 amperes, using an antimony cathode, *lithium antimonide*,  $\text{SbLi}_3$ , is readily obtained as a dark grey substance with a crystalline texture; it readily decomposes water, liberating pure hydrogen. Its melting point is higher than those of its constituents, and its properties will be described later.

The method employed for the preparation of the antimonide is somewhat widely applicable, and alloys of lithium with tin and lead have been obtained in the same way.

C. H. B.

**Action of Lithium-Ammonium on Antimony, and the Properties of Lithium Antimonide.** By PAUL LEBEAU (*Compt. rend.*, 1902, 134, 284—286. Compare preceding abstract).—Lithium antimonide,  $\text{SbLi}_3$ , is formed when a small fragment of antimony is

heated with lithium in a sealed tube containing liquid ammonia; the reaction is completed when the blue colour of the lithium ammonium disappears; or finely powdered antimony may be suspended in liquid ammonia at  $-80^{\circ}$ , and lithium added in successive small portions until a permanent blue coloration is obtained. Lithium antimonide, thus prepared, is a brownish-grey powder in a very fine state of division, having a density 3.2 at  $17^{\circ}$ . It fuses a little above  $950^{\circ}$ , and is therefore less fusible than either of its components. It reacts readily with chlorine, bromine, iodine, sulphur, selenium or tellurium, and burns in oxygen with a violet flame. When heated with arsenic, it yields lithium arsenide. It is more easily decomposed by carbon than the corresponding arsenide. It decomposes hydrogen chloride, bromide, and iodide, the oxides of nitrogen, and sulphur dioxide with incandescence. At a red heat, ammonia is decomposed, hydrogen being evolved. The antimonide dissolves in liquid ammonia, forming a reddish-brown liquid which contains a compound,  $\text{LiSb}_3\text{NH}_3$ . With water, the antimonide reacts at the ordinary temperature, pure hydrogen being evolved, and antimony being formed as a black, flocculent mass; with aqueous acids, a little hydrogen antimonide is also formed. The chlorides, sulphides, and oxides of the metals are reduced by the antimonide.

K. J. P. O.

**Properties of Fused Calcium Oxide.** By HENRI MOISSAN (*Compt. rend.*, 1902, 134, 136—142).—It is not possible to melt pure lime by means of a blowpipe fed by detonating mixtures of hydrogen, acetylene, or carbon monoxide with oxygen; the oxide is, however, fused in an electric arc of 300 amperes and 50—70 volts; with 1000 amperes, fusion and vaporisation proceed simultaneously. The cubical and prismatic crystals found in the cooler parts of the furnace are colourless, transparent, and isotropic; the acicular prisms are, in reality, aggregates of small, superposed cubes, and this crystalline form of the oxide apparently belongs to the cubic system. These crystals, when embedded in Canada balsam, slowly break up into transparent anisotropic fragments, a result which indicates that crystalline calcium oxide is dimorphous. The sp. gr. of the crystallised oxide is 3.40, whilst that of the amorphous variety prepared from marble is 3.30.

The heats of neutralisation of the amorphous and crystalline modifications are identical (compare Gautier, *Abstr.*, 1899, ii, 399). Graphite, when immersed in fused lime, reduces the oxide with the formation of calcium carbide and carbon monoxide; in the presence of excess of the oxide, the carbide is decomposed, carbon monoxide and calcium vapour being evolved in accordance with the following equation,  $\text{CaC}_2 + 2\text{CaO} = 2\text{CO} + 3\text{Ca}$ . Silicon, titanium, and boron, when heated in melted lime, yield respectively calcium silicate, titanate, and borate; boron also gives rise to calcium boride,  $\text{CaB}_6$  (*Abstr.*, 1898, ii, 116). The metals of the iron group, chromium, manganese, iron, cobalt, and nickel, are oxidised by the fused lime, manganese being converted into manganous oxide, whilst chromium is present as the double oxide,  $\text{Cr}_2\text{O}_3 \cdot 4\text{CaO}$ ; traces of chromate are also found owing to the intervention of atmospheric oxygen. All these metals, excepting chromium, when heated in this manner are partially

volatilised, this phenomenon being especially noticeable in the case of manganese. Platinum, when mixed with fused calcium oxide, melts and partly volatilises; that portion of the metal which remains unvolatilised contains 2 or 3 per cent. of calcium. G. T. M.

**Calcium Carbophosphate.** By A. BARILLÉ (*Bied. Centr.*, 1902, 31, 136—137; From *Rép. Pharm.*, 1901, 145).—When dicalcium phosphate suspended in water is heated with carbon dioxide under pressure (13 kilos.), 25 to 50 per cent. dissolves according to the duration of the action. The solution, when exposed to air, deposits crystals of pure dicalcium phosphate. Calcium phosphate similarly treated dissolves to a less extent (10—25 per cent.), and the solution deposits a mixture of dicalcium phosphate and calcium carbonate (1 mol.  $P_2O_5$  to 3 mols.  $CaO$ ).

The author supposes that an unstable carbophosphate of the formula  $H_2Ca_2P_2O_8 \cdot 2CO_2$  is formed, but all attempts to isolate the substance failed. Dry carbon dioxide does not act on dry calcium phosphate. N. H. J. M.

**Chemical Equilibria: Ammonium Phosphates and Barium Chloride.** By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1902, [vii], 25, 197—200).—Monoammonium phosphate in dilute solution does not give precipitates with  $\frac{1}{2}$ , 1, or  $1\frac{1}{2}$  mols. of barium chloride even after several days; the liquid containing these substances is neutral to methyl-orange but acid to litmus or phenolphthalein. Diammonium phosphate gives precipitates with the preceding proportions of barium chloride, and the filtered solution is alkaline to methyl-orange and litmus, but acid to phenolphthalein, and in the last case when the liquid is neutralised with ammonia a slight precipitate is produced. When the solution remains for some time in contact with the precipitate, it becomes more nearly neutral to the three indicators; this change is more marked when the amount of barium salt is considerable.

Triammonium phosphate precipitates 1 atomic proportion of barium from the solution of its chloride; the filtrate is alkaline to the three indicators, and its alkalinity is unaltered when left in contact with the insoluble barium phosphate for 2 days, showing that the precipitation is immediate and complete. When  $1\frac{1}{2}$  mols. of the barium salt are employed, the values obtained on titration vary with the time during which the solution remains in contact with the precipitate. G. T. M.

**Chemical Equilibria: Ammonium Phosphate and Magnesium Chloride.** By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1902, [vii], 25, 200—204. Compare preceding abstract).—The filtrate obtained from a mixture of phosphoric acid, magnesium chloride, and ammonia in dilute solution is alkaline towards methyl-orange, the alkalinity of the rapidly filtered solution varying considerably when the order of mixing is changed. The filtrate is acid to phenolphthalein, the amount of acidity depending on the order of mixing. The greatest departure from neutrality is obtained when the



magnesium chloride (1 mol.) is added to the solution containing phosphoric acid (1 mol.) and ammonia (2 mols.). After 28 hours' contact with the precipitate, the liquid attains a state of equilibrium which is independent of the order of mixing. When the proportion of ammonia is increased to 3 mols., the filtrate still gives the preceding reactions with the indicators, but the variation due to time and order of mixing is far less appreciable; the alkalinity towards methyl-orange is less than in the preceding experiment, although the amount of ammonia present is actually greater; this result is due to the formation of magnesium ammonium phosphate.

G. T. M.

**Thermal Study of some Alloys. Zinc and Aluminium.** By WLADIMIR F. LUGININ and A. SCHUKAREFF (*Arch. Sci. phys. nat.*, 1902, [iv], 13, 5—29).—The authors have attempted to find the heat of formation of a number of zinc-aluminium alloys, in definite proportions, by the determination of the difference of the heats of dissolution in dilute hydrochloric acid, of the alloy, and the mixed metals. The acid employed was of the strength represented by  $\text{HCl}, 10\text{H}_2\text{O}$ , and it was first proved that the products of dissolution were identical in the two cases. The apparatus employed is fully described and the results obtained for the heat of formation of 1 gram of the alloy are:  $\text{Al}_5\text{Zn}$ ,  $-131.7$  cal.;  $\text{Al}_4\text{Zn}$ ,  $-5.0$  cal.;  $\text{Al}_3\text{Zn}$ ,  $+1.4$  cal.;  $\text{Al}_2\text{Zn}$ ,  $+23.4$  cal.;  $\text{AlZn}$ ,  $+9.1$  cal.;  $\text{Al}_2\text{Zn}_3$ ,  $+2.3$  cal.;  $\text{AlZn}_2$ ,  $-4.0$  cal.;  $\text{AlZn}_3$ ,  $+15.2$  cal.; the positive sign indicates development of heat. In no case except the first is the thermal change sufficiently great as to be depended on, and no definite compound of zinc and aluminium is hence indicated.

L. M. J.

**Distillation of Metals and Distilled Metals.** By GEORG W. A. KAHLBAUM, KARL ROTH, and PHILIPP SIEDLER (*Zeit. anorg. Chem.*, 1902, 29, 177—294).—In order to obtain metals in a high state of purity, a number of these have been distilled at low pressure, using the continuous automatic mercury pump previously described by Kahlbaum (*Abstr.*, 1894, ii, 349) and the volumeter of McLeod as modified by Kahlbaum (*Zeit. Instrumentenkunde*, 1895, 191). The distillation was carried out in porcelain tubes, three forms of which have been used. The course of the distillation was followed by taking photograms, by means of Röntgen rays, of the porcelain tubes. The porcelain is transparent to these rays, but the metals are opaque. The purification of tellurium by distillation was examined by observation of the spectrum of the distilled element and it was found that successive distillations remove lines from the spectrum.

The following metals have been distilled and their specific gravities, specific heats, and crystalline forms determined: copper, silver, gold, lead, zinc, cadmium, tellurium, antimony, and bismuth. The specific gravity was determined by a pyknometric method, and the specific heat by a Bunsen calorimeter. The compressibility of the metals was also determined as well as the specific gravity after the pressure had been applied. The results obtained were:

	Cryst. form.	$d\ 20^{\circ}/4$ .	Sp. ht.
Copper .....	Cubic	8.93258	0.09272
Copper, pressed (10,000 atmos.)		8.93764	0.09266
Silver .....	Cubic	10.4923	0.05608
Silver, pressed .....		10.5034	0.05623
Gold .....	Cubic	18.8840	0.0309
Gold, pressed.....		19.2685	0.03087
Lead .....	Cubic	11.3415	0.03053
Lead, pressed.....		11.3470	0.03083
Zinc .....	Rhombohedral (?)	6.9225	0.0939
Zinc, pressed .....		7.12722	0.0940
Cadmium .....	Rhombohedral	8.64819	0.0559
Cadmium, pressed .....		8.64766	0.0560
Tellurium .....	Rhombohedral	6.23538	0.04878
Antimony .....	Rhombohedral	6.61781	0.04973
Antimony, pressed .....		6.69090	0.04957
Bismuth .....		9.78143	0.03055

In the hope of finding a heavy liquid suitable for the specific gravity determinations, the authors examined solutions of barium borotungstate and the corresponding salts of cadmium (Klein's solution), copper, cobalt, nickel, and uranium and of thallium ethoxide and some other thallium alkyloxides. The densities of the solutions were:

Copper borotungstate .....	$d\ 15.8^{\circ}/4^{\circ}$	3.0085
Cobalt borotungstate .....	$d\ 19.2/4$	3.1369
Nickel borotungstate .....	$d\ 15.9/4$	2.2956
Uranium borotungstate .....	$d\ 20.8/4$	1.9442
Cadmium borotungstate .....	$d\ 16.2/4$	3.2868
Thallium ethoxide .....	$d\ 0/4$	3.562
„ „ .....	$d\ 20/4$	3.522

The refractive and dispersive powers of the solutions have also been determined: the value of  $n_{Na}^{20^{\circ}}$  for saturated cobalt borotungstate is 1.5981, and the dispersion  $\Delta = 0.0128$ ; for the copper salt,  $\Delta = 0.0134$ ; for the nickel salt,  $n_{Na}^{20^{\circ}} = 1.4945$ ,  $\Delta = 0.0102$ ; for the cadmium salt,  $n_{Na}^{20^{\circ}} = 1.5836$ ,  $\Delta = 0.0144$ ; for the uranium salt,  $n_{Na}^{20^{\circ}} = 1.4573$ ,  $\Delta = 0.0075$ ; and for thallium ethoxide,  $n_{Na}^{20^{\circ}} = 1.6826$ , and  $\Delta = 0.0286$ .

None of the solutions could be used in the investigation.

J. McC.

**Alloys of Lead and Tellurium.** By HENRY FAY and C. B. GILLSON (*Amer. Chem. J.*, 1902, 27, 81—95).—The freezing points of alloys of lead and tellurium were determined by means of a Le Chatelier pyrometer. The results are tabulated in the original.

The composition of the alloy of maximum freezing point corresponds with the proportions of the metals in lead telluride, PbTe. Lead easily becomes supersaturated with respect to lead telluride, which separates out at the higher freezing point, and the lower freezing point then corresponds with the solidification of the lead. When still

more tellurium is present, lead telluride again separates at the higher temperature, but the lower freezing point corresponds with the complete solidification of the alloy, which is an eutectic of lead telluride and tellurium.

The microstructure of the alloys has been examined; the eutectic can always be seen interspersed between the crystals of lead or tellurium, according to which of these is present in excess.

The hardness of the alloy increases with the amount of tellurium present. The alloys containing more than 50 per cent. of tellurium are very brittle. J. McC.

**Radioactive Lead.** By KARL A. HOFMANN and V. WÖFL (Ber., 1902, 35, 692—694).—A very highly radioactive sulphide can be prepared from pitchblende by heating the lead sulphate with potassium hydroxide and hydrazine sulphate, evaporating with hydrochloric acid and chlorine water, extracting with dilute hydrochloric acid, and precipitating with hydrogen sulphide. The active material differs from bismuth-polonium, radium, and actinium, and reacts similarly to lead. When the sulphide is converted into sulphate, a small amount of active material can be extracted with dilute sulphuric acid, but the residue is also strongly active. Measurements were made of the times required to discharge an electrometer in presence of the different materials.

T. M. L.

**Analysis of Antique Metallic Articles.** By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1902, 134, 142—145).—A Chaldean statuette of the 26th century B.C. consists of 76—77.4 per cent. of copper, 17—18 per cent. of lead, and 2—6 per cent. of sulphur, with traces of iron; the composition of this specimen differs markedly from that of objects of a similar nature dating from the 22nd century B.C., the latter statuettes consisting of almost pure copper. Analyses of Babylonian statuettes of unknown date are also tabulated (compare Abstr., 1901, ii, 25, 318, 386, 615).

G. T. M.

**Constitution of Copper-Tin<sup>2</sup>Alloys.** By CHARLES T. HEYCOCK and FRANCIS H. NEVILLE (*Proc. Roy. Soc.*, 1902, 69, 320—329. Compare Abstr., 1901, 508).—The evidence obtained from a microscopic study of copper-tin alloys chilled at selected temperatures, combined with the results of pyrometric investigation, is interpreted on the basis of Roozeboom's theory of solid solutions. The conclusions thus arrived at are condensed in an equilibrium diagram, to which reference must be made for a full appreciation of the results. The solids which may be at one time or another, according to temperature and concentration, in contact with the liquid alloy, are (1), (2), and (3) mixed crystals of three types, (4) the compound  $\text{Cu}_3\text{Sn}$ , (5) the compound  $\text{CuSn}$ , and (6) pure tin. There is also a substance, supposed to be  $\text{Cu}_4\text{Sn}$ , which is not found in contact with the liquid.

J. C. P.

**Action of Cupric Hydroxide on Aqueous Solutions of Metallic Salts.** By AMABLE MAILHE (*Compt. rend.*, 1902, 134, 233—236. Compare Abstr., 1901, ii, 601. and this vol., ii, 140).—The action of cupric hydroxide on aqueous solutions of cupric, cobaltous,

nickel, and manganous nitrates yields crystalline double salts of the type  $M(NO_3)_2 \cdot 3CuO \cdot 3H_2O$ . In some cases, the blue hydroxide gives better results than the black hydroxide, and the action is accelerated by heating. Cadmium nitrate yields a compound not quite of the same type:  $Cd(NO_3)_2 \cdot CuO \cdot 5H_2O$ , whilst mercuric and lead nitrates give the basic nitrates  $Hg(NO_3)_2 \cdot HgO \cdot H_2O$ ;  $Pb(NO_3)_2 \cdot PbO \cdot H_2O$ . Iron (ferrie) and aluminium are completely displaced from solutions of their nitrates by cupric hydroxide.

C. H. B.

\*Preparation of Metals of the Cerium Group by Electrolytic Fusion. By WILHELM MUTHMANN, H. HOFER, and L. WEISS (*Annalen*, 1902, 320, 231—269).—The authors employ a jacketed copper crucible which can be cooled with water throughout the electrolysis. The electrodes are carbon rods, the cathode passing through the bottom of the crucible; the temperature is regulated by means of smaller carbon rods, 3 mm. in thickness, and 23 mm. in length, placed between the electrode terminals.

When a current of 40 amperes and 10—12 volts is employed with this apparatus, cryolite is readily melted, and on removing the connecting small carbon rods the electrolysis sets in, the current strength now being 8—10 amperes with 60—65 volts. Lead chloride is conveniently electrolysed with a current of 30—35 amperes and 8—10 volts.

Anhydrous cerous chloride, mixed with 10 per cent. of a mixture of sodium and potassium chlorides, is electrolysed with a current of 30—40 amperes and 12—15 volts; the metal isolated contains 99.92 per cent. of cerium. Cerium is only slightly oxidised in dry air; it slowly decomposes water in the cold, but more rapidly on heating. Nitric acid, even when moderately dilute, attacks cerium, yielding a brown hydroxide,  $H_2CeO_3$ , a substance which yields the dioxide on heating.

Neodymium is obtained when its chloride is electrolysed with a current of 56 amperes and 25 volts; barium chloride is added from time to time because this salt has the property of decreasing the conductivity of the fused mass, and in this way increasing the temperature. Neodymium is a silvery white metal, whilst cerium has an iron-grey colour. The former metal has the higher melting point, and is the more oxidisable; it decomposes water especially on warming and is attacked by all acids.

A mixture of cryolite and one of the oxides of cerium yields on electrolysis an alloy of cerium and aluminium. Cerium carbide,  $CeC_2$ , is obtained from the dioxide by electrolysis in the presence of carbon. This substance yields a mixture of acetylene and ethylene when treated with hydrochloric acid.

The remainder of the communication is devoted to the description of methods for obtaining derivatives of the cerium group of metals in a pure state; the memoir also contains four plates illustrating the electrolytic apparatus.

G. T. M.

New Method of separating Cerium from Mixtures of Rare Earths. By RICHARD JOS. MEYER and M. KOSS (*Ber.*, 1902, 35, 672—678).—The complete separation of cerium from a mixture of rare earths can be readily effected by boiling with magnesium acetate, which precipitates quadrivalent cerium, but leaves the other earths



in solution; the precipitate is not quite pure, but is readily soluble in nitric acid, and can therefore be easily purified, if required, by precipitating the double salt with ammonium nitrate.

Ceric salts are precipitated quantitatively as a basic acetate by sodium acetate in a hot solution, but the precipitate dissolves again to some extent on cooling and must therefore be filtered while hot; didymium and lanthanum are not precipitated by this method, but didymium is always carried down with the cerium from a solution containing both elements. Cerium can be precipitated from a neutral solution of the nitrate by hydrogen peroxide and sodium acetate, but didymium is also thrown down when the hydrogen peroxide is in excess, although lanthanum remains entirely in solution; the method is not technically applicable to the separation of cerium, but may possibly serve for the separation of didymium from lanthanum.

The use of magnesium acetate overcomes most of the difficulties experienced with sodium acetate, and allows of a complete technical separation of cerium in one operation, the only impurity being 3 to 4 per cent. of didymium, which can readily be removed in a subsequent operation.

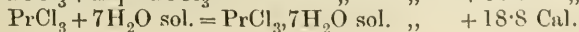
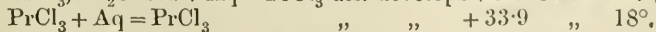
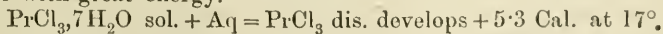
T. M. L.

**Action of Hypochlorous Acid on Praseodymium Dioxide.** By PETR. G. MELIKOFF and B. E. KLIMENKO (*J. Russ. Phys. Chem. Soc.*, 1901, 33, 739—740. Compare this vol., ii, 140).—The action of hypochlorous acid on praseodymium dioxide gives rise to the evolution of oxygen and the formation of chloric acid. In this reaction, which proceeds very slowly in the cold, but much more energetically at higher temperatures, no ozone is given off, and any which is formed must be at once used up in oxidising the hypochlorous acid.

T. H. P.

**Praseodymium Chloride.** By CAMILLE MATIGNON (*Compt. rend.*, 1902, 134, 427—429).—Hydrated praseodymium chloride,  $\text{PrCl}_3 \cdot 7\text{H}_2\text{O}$ , loses water slowly at the ordinary temperature in a dry atmosphere, and tends to produce a hydrate,  $\text{PrCl}_3 \cdot 3\text{H}_2\text{O}$ . If heated at  $115^\circ$ , it loses water and hydrogen chloride and is converted into an oxychloride. If, however, it is heated in a current of dry hydrogen chloride at  $108^\circ$ , it yields a new hydrate,  $\text{PrCl}_3 \cdot \text{H}_2\text{O}$ , and at  $185^\circ$  becomes anhydrous without formation of any oxychloride. The heptahydrate begins to melt at  $105^\circ$ , and loses water. It dissolves readily in water, and the solution saturated at  $13^\circ$  has sp. gr. 1.687 at  $16^\circ/4^\circ$ ; 100 parts contain 76.97 parts of the hydrated salt or 50.96 parts of the anhydrous salt. At  $100^\circ$ , the solubility in water is unlimited. In dilute hydrochloric acid, the solubility diminishes in accordance with Engel's law. A concentrated solution of the chloride dissolves praseodymium oxalate, and other oxalates of the rare metals, forming crystallisable oxalochlorides.

The anhydrous chloride melts at a red heat, forming a green liquid, which is not sensibly volatile at  $100^\circ$ . The salt combines with water with great energy.



The anhydrous chloride is very soluble in alcohol but is insoluble in ether and most organic liquids, or in inorganic chlorides such as phosphorus trichloride, or stannic chloride. C. H. B.

**Aluminium-Iron and Aluminium-Manganese Alloys.** By LÉON GUILLET (*Compt. rend.*, 1902, 134, 236—238).—When an intimate mixture of aluminium and ferric oxide is heated, the limit of inflammation corresponds with a mixture which should yield the alloy  $\text{FeAl}$ , but if the mixture is previously heated at  $800^\circ$  the limit of inflammation may be extended to the mixture yielding  $\text{FeAl}_4$ . The product from mixtures between  $\text{FeAl}$  and  $\text{Fe}_{10}\text{Al}$  rapidly falls to a powder containing tetrahedral crystals of the compound  $\text{Fe}_2\text{Al}_3$ , which seems to correspond with the maximum of the curve of fusibility. Products between  $\text{FeAl}_2$  and  $\text{FeAl}_4$  yield prismatic crystals, often 60 to 80 mm. long, of the compound  $\text{FeAl}_3$ .

With aluminium and manganic oxide, the limit of inflammation corresponds with a mixture which should yield  $\text{MnAl}_4$ , but by previous heating can be extended to the mixture which should yield  $\text{MnAl}_6$ . There is, however, always considerable loss in the form of manganous oxide. Products between the limits  $\text{MnAl}_3$  and  $\text{MnAl}_2$  rapidly fall to powder containing crystals of the compound  $\text{MnAl}_3$ , which can be isolated by treatment with dilute hydrochloric acid. Products between  $\text{Mn}_2\text{Al}$  and  $\text{Mn}_5\text{Al}$  behave similarly, but yield crystals of the compound  $\text{Mn}_2\text{Al}_3$ . A mixture of manganic oxide and aluminium in the proportions to form  $\text{MnAl}_4$  yields a small quantity of this compound in filiform crystals in a mass of corundum. C. H. B.

**Cementation of Iron by Silicon.** By PAUL LEBEAU (*Bull. Soc. Chim.*, 1902, [iii], 27, 44—45).—By heating iron embedded in crystals of silicon at the temperature of a good forge, Moissan (Abstr., 1896, ii, 173) found that the two substances combined to form iron silicide. The author now shows that combination of the two elements takes place at a much lower temperature ( $950^\circ$ ), the process therefore resembling the cementation of iron by carbon. A. F.

**Crystallisation of Chromic Oxide.** By ALFRED DITTE (*Compt. rend.*, 1902, 134, 336—343).—It is well known that when a mixture of potassium dichromate and sodium chloride is heated to bright redness, a considerable quantity of chromic oxide is obtained crystallised in thin, brilliant plates, and the result is generally attributed to a dissolution of the chromic oxide in the fused sodium chloride. No similar result is obtained with potassium dichromate and potassium chloride, and direct experiment shows that amorphous chromic oxide does not become crystallised when fused with sodium chloride. On the other hand, the crystallised oxide is readily obtained by heating a mixture of sodium dichromate and sodium chloride. The explanation of the change, and of the different behaviour of potassium chloride, lies in the relatively high stability of potassium chlorochromate on the one hand, and the instability of the corresponding sodium salt on the other. When a dichromate is fused with sodium chloride, chromyl dichloride is produced, and it is the decomposition of this substance that yields

the crystallised chromic oxide. If potassium chloride is substituted for the sodium salt, only a small quantity of chromyl dichloride is produced owing to the comparative stability of the potassium chlorochromate, which is the primary product. C. H. B.

**Molybdenum Oxides.** By MARCEL GUICHARD (*Compt. rend.*, 1902, 134, 173—174. Compare Abstr., 1900, ii, 80, 658; 1901, ii, 659).—The researches of Klason (see Abstr., 1901, ii, 162, 163) and Bailhache indicate that there are at least five blue oxides of molybdenum. In all probability, however, these different oxides either correspond with the blue oxide prepared by the author, or are mixtures of this compound with molybdenum trioxide. G. T. M.

**Analysis of the Lower Oxides of Molybdenum and of Metallic Molybdenum.** By CARL FRIEDHEIM and M. K. HOFFMANN (*Ber.*, 1902, 35, 791—798).—Molybdenum dioxide ( $\text{MoO}_2$ ) can be very easily prepared in a perfectly pure state by a modification of Guichard's method; the trioxide, is heated in hydrogen at the boiling point of sulphur and the product, which is a mixture of dioxide and trioxide, heated to dull redness in dry hydrogen chloride, when the trioxide is converted into a volatile oxychloride, and is thus removed.

The amount of molybdenum dioxide in one of the soluble or insoluble lower oxides of molybdenum can readily be estimated by treating the oxide with excess of a 10 per cent. solution of ferric ammonium sulphate, when the dioxide is oxidised to trioxide. The ferrous salt thus produced is titrated with standard potassium permanganate. In the case of a soluble lower oxide of molybdenum, a known excess of acidified potassium permanganate may be directly added, the excess being estimated by standard oxalic acid.

Metallic molybdenum is similarly quantitatively converted into the trioxide by ferric sulphate and can thus be estimated.

The authors find that the known process for estimating molybdenum and molybdenum dioxide, which is based on the reduction of ammoniacal silver nitrate to metallic silver, yields good results when very dilute ammoniacal silver sulphate is employed. The precipitated silver is collected and washed with a 10 per cent. solution of ammonium nitrate, and is then dissolved in nitric acid and weighed as chloride or titrated with ammonium thiocyanate. K. J. P. O.

**Tungsten, Molybdenum, Uranium, and Titanium. III.** By ALFRED STAVENHAGEN and E. SCHUCHARD (*Ber.*, 1902, 35, 909—912. Compare Abstr., 1899, ii, 489; 1900, ii, 80).—The following alloys were prepared by the method of aluminium-reduction: WCo, WMo, MoU, MoFe, MoSb, UFe, UCo, UMn, TiFe, TiCo, TiCu, PbW, PbMo, FeBa, CrCoWMo, TiWMo, MoUCrTi, and FeMnU. T. M. L.

**Tin Sponge and Crystals formed by Electrolysis.** By W. PFANHAUSER, jr. (*Zeit. Elektrochem.*, 1902, 8, 41—43).—When solutions of stannous or stannic chloride of more than normal strength are electrolysed with a current density at the cathode exceeding 0.01 ampere per sq. cm., crystals of tin are deposited. With more dilute

solutions, spongy tin is formed, whilst small currents deposit coherent metal from the concentrated solutions. T. E.

**Enantiotropy of Tin.** VII. By ERNST COHEN (*Proc. K. Akad. Wetensch. Amsterdam*, 1901, 4, 377—378. Compare Abstr., 1900, ii, 83, 212, 408; 1901, ii, 106, 244).—Analytical examination shows that the tin used by the author in his previous researches contains only the slightest traces of impurities. J. C. P.

**Alloys of Antimony and Tellurium.** By HENRY FAY and HARRISON EVERETT ASHLEY (*Amer. Chem. J.*, 1902, 27, 95—105).—The freezing points of a series of antimony and tellurium alloys were determined by the Le Chatelier pyrometer, and the specific gravities were also determined.

The composition of the alloy with maximum freezing point corresponds with the formula  $\text{Sb}_2\text{Te}_3$ . The compound forms an eutectic alloy (containing 87 per cent. of tellurium, and melting at  $421^\circ$ ) with tellurium; it is isomorphous with antimony.

The specific gravities found for the alloys are of little value, for it was almost impossible to obtain them free from air cavities.

Under the microscope, the alloy containing 61.37 per cent. of tellurium appeared absolutely uniform. When more tellurium is present, eutectic alloy and antimony telluride can both be clearly seen. J. McC.

**Preparation of Tantalum in the Electric Furnace and its Properties.** By HENRI MOISSAN (*Compt. rend.*, 1902, 134, 211—215).—When tantalum pentoxide is mixed with somewhat less than the calculated quantity of sugar-carbon, and heated for not less than 10 minutes in the electric furnace with a current of 60 volts and 800 amperes, a fused mass of metallic tantalum is obtained, containing 0.5 to 2.5 per cent. of carbon. It is brittle, and has a crystalline fracture; its sp. gr. is 12.79, which is considerably higher than that given by Berzelius or Rose. Finely powdered tantalum burns in fluorine at the ordinary temperature; in chlorine, it is attacked at  $150^\circ$ , and burns at about  $250^\circ$ ; in bromine vapour, it is attacked at a red heat, but not in iodine vapour even at  $600^\circ$ . It burns in oxygen at  $600^\circ$ , but is not affected by sulphur, selenium, or tellurium vapour at  $700^\circ$ , or by phosphorus or arsenic at their boiling points, or by nitrogen at  $1200^\circ$ . Hydrogen chloride attacks tantalum with liberation of hydrogen, but water vapour and hydrogen sulphide have little or no action at  $600^\circ$ . Ammonia is decomposed at a dull red heat, but the tantalum does not increase in weight. Tantalum shows very little tendency to combine with metals. It reduces sulphur dioxide and nitrous and nitric oxides with incandescence at about  $500^\circ$ , phosphorus and arsenic pentoxides below a red heat, and iodic anhydride on gently heating. It also readily reduces lead and manganese peroxides, lead monoxide, and mercurous and mercuric chlorides. It is oxidised by fused potassium hydroxide, but is not attacked by fused potassium chlorate, and in this respect differs from



niobium. It is also less readily attacked than niobium by fused potassium nitrate. Tantalum is not attacked by single acids or by aqua regia, but like niobium and silicon it is oxidised by a mixture of aqua regia and hydrofluoric acid. In general chemical behaviour, tantalum resembles the non-metals rather than the metals. C. H. B.

**Platinum Tetraiodide.** By ITALO BELLUCCI (*Atti R. Accad. Lincei*, 1902, [v], 11, i, 8—12).—The author finds that, like the chloride and bromide, platinic iodide behaves as an anhydride and takes up 2 mols. of water to form an acid of the composition  $[\text{PtI}_4(\text{OH})_2]\text{H}_2$ . This is shown by allowing the iodide to remain for some time in contact with 95 per cent. alcohol, by which means a solution having an intense chestnut-brown colour is obtained. This liquid, which is decomposed by light, has an acid reaction and decomposes carbonates. When treated with concentrated aqueous solutions of salts of various metals, it yields precipitates which are found to be salts of an acid having the formula just given: The following salts, which are, in general, of a reddish-brown or chestnut colour, have been prepared:  $[\text{PtI}_4(\text{OH})_2]\text{Ag}_2$ ;  $[\text{PtI}_4(\text{OH})_2]\text{Pb}, \text{Pb}(\text{OH})_2$ ;  $[\text{PtI}_4(\text{OH})_2]\text{Ti}_2$ ; and  $[\text{PtI}_4(\text{OH})_2]\text{Hg}$ . T. H. P.

## Mineralogical Chemistry.

**Chalmersite, a New Sulphide of the Copper-glance Group.** By EUGEN HUSSAK (*Centr. Min.*, 1902, 69—72).—This mineral is found associated with copper-pyrites, pyrrhotite, calcite, siderite, dolomite, albite, quartz, &c., in the Morro Velho gold-mine, Minas Geraes, Brazil. The acicular crystals are very similar to copper-glance in habit, twinning and angles [ $a:b:c=0.5734:1:0.9649$ ]. The colour is bronze-yellow;  $H=3\frac{1}{2}$ ; sp. gr. 4.68. The mineral is magnetic like pyrrhotite. From the following analysis by Florence (on only 0.016 gram) the formula is given as  $\text{Cu}_2\text{S}, \text{Fe}_6\text{S}_7$ :

Fe.	Cu.	S.	Total.
46.95	17.04	35.30	99.29

The mineral is isomorphous with copper-glance, and its existence suggests that there may be a form of  $\text{Fe}_n\text{S}_{n+1}$  dimorphous with pyrrhotite. The fact that copper-glance has not been found at Morro Velho is considered to negative the suggestion that the new mineral may be only crystals of copper-glance partly replaced by pyrrhotite.

L. J. S.

**New Occurrence of Sperrylite.** By HORACE L. WELLS and SAMUEL L. PENFIELD (*Amer. J. Sci.*, 1902, [iv], 13, 95—96).—A specimen of platiniferous copper ore from the Rambler mine in the Medicine Bow Mountains, Wyoming, was found to consist of covellite enclosing a few minute cubic crystals of sperrylite ( $\text{PtAs}_2$ ).

L. J. S.

**Analysis of the Saccharoid Marble of Carrara.** By EGIDIO POLLACCI (*Gazzetta*, 1902, 32, i, 83—87).—This marble is white, with occasional bluish-black veins and blackish, linear dottings, and gives a saccharoidal fracture. Under the lens, it appears to be formed of crystals in which the rhombobedral form is visible. Its composition in parts per 1000 is: CaO, 553·8; MgO, 5·891; Fe<sub>2</sub>O<sub>3</sub> (maximum), 0·6834; Al<sub>2</sub>O<sub>3</sub>, 0·5024; Na<sub>2</sub>O, 0·1334; (NH<sub>4</sub>)<sub>2</sub>O, 0·1116; CO<sub>2</sub>, 436·96; P<sub>2</sub>O<sub>5</sub>, 0·965; Cl, 0·458; SO<sub>3</sub>, 0·18; N<sub>2</sub>O<sub>5</sub>, 0·0025; N<sub>2</sub>O<sub>3</sub>, 0·0004; SiO<sub>2</sub>, 0·01; organic matter, 0·079; difference, 0·2233. The author considers that the above analysis leaves no room for doubt as to the organic origin of the marble.

T. H. P.

**The Marbles of Assynt.** By J. J. HARRIS TEALL and WILLIAM POLLARD (*Summary of Progress, Geol. Survey United Kingdom* for 1900, 1901, 151—156).—The plutonic mass of Cnoc na Sròine in Sutherland, consisting mainly of red granite or syenite, shading off into typical nepheline-syenite and borolanite, is intrusive into Durness dolomites. The metamorphosed dolomites contain, in different portions, brucite, diopside, tremolite, mica, forsterite and serpentine. Brucite (anal. I, sp. gr. 2·41) occurs in fibrous or scaly aggregates, and is probably an alteration product after periclase; in association with calcite and dolomite, it forms a white rock practically identical with the predazzite of the Tyrol. Forsterite (anal. II and III) occurs as grains in a white rock, composed of this mineral and calcite; the serpentine (ophicalcite) has been derived by its alteration. Analysis IV is of forsterite from Skye. In other varieties of the altered rocks, tremolite is invariably associated with calcite, whilst diopside is frequently associated with dolomite, thus indicating that the rocks are altered siliceous dolomites, since the development of tremolite (CaO, 3MgO, 4SiO<sub>2</sub>) in dolomite would naturally be accompanied by the formation of calcite, whereas diopside (CaO, MgO, 2SiO<sub>2</sub>) could be formed directly by the simple substitution of silica for carbon dioxide.

In some cases, a green ægirine-augite (anal. V, also TiO<sub>2</sub>, Li<sub>2</sub>O, traces) occurs in the dolomite, indicating that there has been an intimate blending of sedimentary and igneous material accompanied by some interchange of constituents:

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	MnO.	CaO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	Loss on igni- tion.	Total.
I.	0·4	1·4		—	—	0·8	66·0	—	—	31·2	99·8
II.	42·2	0·8	0·5	—	—	0·3	57·0	—	—	0·3	101·1
III.	42·6	1·2	1·2	—	—	0·6	51·2	—	—	3·1	99·9
IV.	41·5	0·9	1·4	—	—	0·3	55·6	—	—	1·2	100·9
V.	53·58	1·32	9·46	3·36	0·31	16·82	11·67	0·20	3·31	0·73	100·76

Analyses are also given of rocks, and of the felspars isolated from them, from the North-west Highlands.

L. J. S.

**Anapaite: a New Mineral.** By A. SACHS (*Sitzungsber. Akad. Wiss. Berlin*, 1902, 18—21).—This mineral was found on limonite in the iron mine Scheljesni Bog, near Anapa, on the Black Sea. It forms platy or radially crystallised masses, less often distinct, transparent crys-

tals, of a pale greenish colour and with a bright vitreous lustre. Results are given of the goniometric measurements and optical determinations made on the triclinic crystals. Analysis gave the following results, from which is deduced the formula  $\text{FeCa}_2(\text{PO}_4)_2 \cdot 4\text{H}_2\text{O}$ . Water is expelled only at a high temperature, and it has an acid reaction :

FeO.	CaO.	P <sub>2</sub> O <sub>5</sub> .	H <sub>2</sub> O.	Alkalis.	Total.	Sp. gr.
18·07	27·77	35·51	18·47	trace	99·82	2·81

The new mineral is closely related to, but considered to be distinct from, the triclinic messelite,  $(\text{Ca}, \text{Fe}, \text{Mg})_3(\text{PO}_4)_2 \cdot 2\frac{1}{2}\text{H}_2\text{O}$ , for which was approximately determined the angle  $am = 42-43^\circ$ , and the extinction on  $a$ , referred to the edge  $a/m$ ,  $= 20^\circ$ ; the corresponding values for anapaite are  $44^\circ 55'$  and  $15^\circ$ .  
L. J. S.

**Wavellite from Manziana (Province of Rome).** By FER-  
RUCCIO ZAMBONINI (*Atti R. Accad. Lincei*, 1902, [v], 11, i, 123—125).  
—The author describes a specimen of wavellite, occurring in spheres and hemispheres having a perfect, radiating, fibrous structure and a very pale greenish surface colour. Its composition is: P<sub>2</sub>O<sub>5</sub>, 33·76; Al<sub>2</sub>O<sub>3</sub>, 37·11; H<sub>2</sub>O, 26·69, and F, 2·05 per cent., which agrees well with that given by Groth.  
T. H. P.

**Action of Ammonium Chloride on certain Silicates.** By  
FRANK W. CLARKE and GEORGE STEIGER (*Amer. J. Sci.*, 1902, [iv], 13, 27—38. Compare Abstr., 1900, ii, 24, 219, 414).—In continuing their investigation of the action of ammonium chloride on silicates, the authors now give their results obtained with the following minerals. Stilbite from Wasson's Bluff, Nova Scotia (anal. I, fractional water under 1A); heulandite from Berufjord, Iceland (anal. II); chabazite from Wasson's Bluff, Nova Scotia (anal. III, fractional water IIIA); thomsonite from Table Mountain, Golden, Colorado (anal. IV, fractional water IVA); ilvaite from Golconda Mine, Owyhee Co., Idaho (anal. V, by Hillebrand; H<sub>2</sub>O at 105°, 0·15; above 105°, 2·64); agirite from Magnet Cove, Arkansas (anal. VI; H<sub>2</sub>O at 100° 0·15; above 100°, 0·40). Also riebeckite (?), serpentine, leuchtenbergite, and phlogopite, of which analyses have already been published :

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	MnO.	CaO.
I.	55·41	16·85	0·18	—	—	7·78
II.	57·10	16·82	—	—	—	6·95
III.	50·78	17·18	0·40	—	—	7·84
IV.	41·13	29·58	—	—	—	11·25
V.	29·16	0·52	20·40	29·14	5·15	13·02
VI.	50·45	2·76	23·42	5·26	0·10	5·92

	SrO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Total.
I.	—	0·05	—	1·23	19·01	100·51
II.	0·46	0·07	0·42	1·25	16·61	99·68
III.	—	0·04	0·73	1·28	21·85	100·10
IV.	—	—	—	5·31	13·13	100·40
V.	—	0·15	—	0·08	2·79	100·41
VI.	—	1·48	0·24	—	0·55	100·02

	H <sub>2</sub> O at 100°	180°	250°	350°	Low redness.	Full redness.	Blowpipe.	Total.
IA.	3.60	6.46	3.80	2.10	2.95	0.06	0.04	19.01
IIA.	3.62	13.00						16.61
IIIA.	5.22	5.70	3.92	2.36	4.51	0.13	0.01	21.85
IVA.	1.01	1.44	1.05	3.90	5.65	—	0.08	13.13

The zeolites, stilbite, &c., behave in much the same manner as previously described for other zeolites, natrolite, &c. (*Abstr.*, 1900, ii, 414). When heated in a sealed tube with ammonium chloride at 350°, they are decomposed with the formation of ammonium derivatives, ammonium more or less completely replacing the calcium and sodium. From these zeolites, either before or after ignition, very little silica is extracted by sodium carbonate solution; they cannot therefore be represented as metasilicates. Stilbite, heulandite and chabazite approximate more or less nearly to trisilicates in their composition, whilst thomsonite is essentially an orthosilicate with variable admixtures of trisilicate molecules.

The other minerals examined do not yield ammonium derivatives when heated with ammonium chloride, but ilvaite is strongly attacked, riebeckite moderately, and the others only feebly.

L. J. S.

**Composition of Yttrialite and Thalenite.** By WILLIAM F. HILLEBRAND (*Amer. J. Sci.*, 1902, [iv], 13, 145—152).—The formula,  $R_2O_3 \cdot 2SiO_2$ , of yttrialite having recently been called into question, the mineral has been submitted to a new analysis, but with no very satisfactory result. The material analysed was purified with acid; the sp. gr. before being so treated was 4.59, and afterwards 4.65. The new results are:

SiO <sub>2</sub> .	TiO <sub>2</sub> .	ThO <sub>2</sub> .	UO <sub>2</sub> .	Ce <sub>2</sub> O <sub>3</sub> .	La <sub>2</sub> O <sub>3</sub> , &c.	Y <sub>2</sub> O <sub>3</sub> , &c.	Fe <sub>2</sub> O <sub>3</sub> .	FeO.
29.63	0.05	10.85	1.64	3.07	5.18	43.45	0.76	1.96

MnO.	PbO.	CaO.	MgO.	H <sub>2</sub> O(>105°).	H <sub>2</sub> O(<105°).	CO <sub>2</sub> .	P <sub>2</sub> O <sub>5</sub>	F,	Alkalis.	Total
0.88	0.80	0.67	0.16	0.32	0.04	0.11	0.12	traces		99.69

Between 1 and 2 c.c. of nitrogen (?) and helium (?) are present in a gram of yttrialite. These results, which agree fairly well with Mackintosh's analysis, lead to the formula  $R''_{61}R'''_{286}R''''_{47}(Si_2O_7)_{247}$ , or deducting the thorium and uranium as thorite,  $R''_{61}R'''_{286}Si_{447}O_{1533}$ : the latter, written as a basic salt of metasilicic acid, is approximately  $R'R'_3(R''O)'_3(SiO_3)_7$ . Reasons are given for considering as doubtful the formula assigned to the recently described mineral thalenite (*Abstr.*, 1899, ii, 766). Possibly the presence of helium and other gases in these minerals may have something to do with the difficulty in deducing satisfactory formulæ.

L. J. S.

**Mineral Water of Poleo, near Schio [Italy].** By PIETRO SPICA and GUIDO SCHIAVON (*Gazzetta*, 1902, 32, i, 63—74).—This water, when collected, was issuing at the rate of 1.16 litres per minute at a temperature of 13.9°, that of the air being 25°; its sp. gr. is 1.0012 at 25°/4°. A detailed analysis is given of the water, which may be classed as ferrugino-manganiferous.

T. H. P.



Mineral Water from the Jolanda Spring, near Staro [Italy]. By PIETRO SPICA and GUIDO SCHIAVON (*Gazzetta*, 1902, 32, i, 75—83).—This water much resembles that from the Royal Spring near Staro. A detailed analysis is given. T. H. P.

## Physiological Chemistry.

Blood-Platelets. By GEORGE T. KEMP and O. O. STANLEY (*Proc. Amer. Physiol. Soc.*, 1902; *Amer. J. Physiol.*, 6, xi).—Blood-platelets on agar-agar containing sodium hexametaphosphate, execute amœboid movements; this confirms an observation previously made by Dietjen (*Virchow's Archiv*, 1901, 164, 239). After intravenous injection of methylene-blue, the platelets contain blue-stained granules. The granules appear to be composed of nucleo-proteid. W. D. H.

The Number of Blood-Platelets at High Altitudes. By GEORGE T. KEMP (*Proc. Amer. Physiol. Soc.*, 1902; *Amer. J. Physiol.*, 6, xi—xii).—The red corpuscles and platelets were counted in Paris; the mean per cubic millimetre gave 4,800,000 and 457,000 respectively; the ratio of platelets to red corpuscles was thus 1:10.5. In forty-eight hours a journey was made to the Gorner Grat, 10,290 feet above sea level; the ascent was made by railway to exclude fatigue. Seventy-two hours after the last count in Paris, the numbers were 7,000,000 and 1,206,900, the ratio being 1:5.8. The size of the platelets had increased; the number of small red corpuscles was also large; no connecting form between the two could be discovered. W. D. H.

Rôle of the Cell Nucleus in Oxidation and Synthesis. By R. S. LILLIE (*Proc. Amer. Physiol. Soc.*, 1902; *Amer. J. Physiol.*, 6, xv—xvi).—Fresh and alcoholic tissues of the frog were treated with an alkaline solution of *p*-phenylenediamine and  $\alpha$ -naphthol. This turns violet on oxidation from the formation of indophenol. The coloration is most intense, and appears most readily in those regions where nuclei are most densely aggregated; for instance, in kidney, spleen, and thymus. The phenomenon is prevented by acids, by reducing substances, and by poisons like hydrocyanic acid, which interfere with oxidation. W. D. H.

Occurrence of *p*-Hydroxyphenylethylamine in Pancreatic Digestion. Fermentative Origin of Carbon Dioxide. By R. L. EMERSON (*Beitr. chem. Physiol. Path.*, 1902, 1, 501—508).—In addition to the numerous substances of small molecular weight which are known to result from the pancreatic digestion of proteids, there are several others, of which one only, *p*-hydroxyphenylethylamine, is described in the present paper; as it increases, the amount of tyrosine diminishes, hence it is formed from the latter by removal of the elements of carbon

dioxide. This fermentative formation of carbon dioxide without the taking up of oxygen or water is regarded as a point of interest.

W. D. H.

**The End Product of Peptic Digestion.** By LEO LANGSTEIN (*Beitr. chem. Physiol. Path.*, 1902, 1, 507—523).—Very prolonged gastric digestion leads to the formation of simple products similar to those produced in a shorter time by the pancreatic digestion of proteids. Among the substances identified were leucine, tyrosine, glutamic acid, and (probably) *p*-hydroxyphenylethylamine; the substances intermediate between peptone and amino-acids, described by Pfäundler were not discovered; possibly in these experiments digestion had gone too far.

W. D. H.

**Influence of Hydroxides of Barium, Calcium, and Strontium on Tryptic Digestion.** By ALBERT DIETZE (*Chem. Centr.*, 1902, i, 328—329; from *Inaug. Diss. Leipzig*, 1900).—The optimum of tryptic digestion was obtained if the digestive fluid contains barium hydroxide, 0.06 to 0.15, calcium hydroxide, 0.034 to 0.054, or strontium hydroxide, 0.058 to 0.085 per cent. These numbers correspond with a gram-mol. in from 114 to 285 litres. In the case of potassium carbonate, the optimum of digestion is obtained where a gram-mol. is dissolved in from 13 to 25 litres.

W. D. H.

**Metabolism in Horses.** By THEODOR PFEIFFER (*Landw. Versuchs-Stat.*, 1902, 56, 283—288).—A criticism of Zuntz and Hagemann's experiments and conclusions (*ibid.*, 1901, 55, 112; compare Pfeiffer, *Abstr.*, 1900, ii, 554).

N. H. J. M.

[**Metabolism in Horses.**] By NATHAN ZUNTZ and O. HAGEMANN (*Landw. Versuchs-Stat.*, 1902, 56, 289—292).—A reply to Pfeiffer (preceding abstract).

**Formation of Phenol and Indoxyl as Intermediate Metabolic Products and their Relationship to Glycuronic Acid Excretion.** By CARL LEWIN (*Beitr. chem. Physiol. Path.*, 1902, 1, 472—500).—In phloridzin diabetes there is an increase in the indoxyl and phenol excreted. This is not due to intestinal putrefaction, but the substances in question are intermediate metabolites. Accompanying this there is an increase in the amount of glycuronic acid, which is probably the result of the phenol and indoxyl produced, and the acid is excreted in combination with these aromatic substances.

W. D. H.

**Metabolism of Phosphorus, Calcium, and Magnesium in Herbivora.** By FERENCZ TANGL (*Pflüger's Archiv*, 1902, 89, 227—239).—Experiments on horses, the principal conclusions from which are that the amount of drinking water makes no difference either on the absorption or metabolism of calcium and magnesium; that the amount of phosphorus in the urine shows some parallelism to nitrogen, and rises when that in the food increases; that the amount of calcium and magnesium in the excreta depends on the amount in the food. There appears to be some retention of calcium, for foods poor in that element may be taken for some time without injurious effects.

W. D. H.

**Influence of Fat and Carbohydrate on Proteid Metabolism.** By T. W. TALLQVIST (*Arch. Hygiene*, 1902, 41, 177—189).—The experiments on the author's person confirm the statement, made previously by several observers, that carbohydrate has a greater 'proteid-sparing' action than fat. Within the limits of the diets employed, the changed proportion between fat and carbohydrate has, however, very little influence on the total nitrogenous exchange.

W. D. H.

**Synthesis of Proteid in the Animal Body.** By OTTO LOEWI (*Chem. Centr.*, 1902, i, 329; from *Centr. Physiol.*, 1902, 15, 590—591).—A small dog was kept in nitrogenous equilibrium by feeding it on starch and sugar, *plus* the products of a pancreatic digestion which had passed beyond the stage of the biuret reaction. This confirms Kutscher and Seemann's, and also Cohnheim's, observations that the body is capable of synthesising proteids from its simpler constituents.

W. D. H.

**Absorption of Fat.** By EDUARD PFLÜGER (*Pflüger's Archiv*, 1902, 89, 211—226).—Polemical against O. Loewi.

W. D. H.

**Formation of Iodised Fat in the Mammary Glands.** By F. JANTZEN (*Chem. Centr.*, 1902, i, 219; from *Centr. Physiol.*, 1901, 15, 506—511).—Winternitz and Caspari consider the appearance of iodised fat in the milk after it has been given in the food as a proof that the food fat passes unchanged into the milk fat. That this assumption is incorrect is shown by the present experiments, for iodised casein (incompletely free from fat, it is true) leads to the same result. Iodide of starch and alkali iodides have not this effect.

W. D. H.

**Formation of Sugar from Fat.** By OTTO LOEWI (*Chem. Centr.*, 1902, i, 220—221; from *Arch. exp. Path. Pharm.*, 1901, 47, 68—76).—If fat is given to dogs suffering from phloridzin diabetes, or to human beings with severe diabetes, the relation of sugar to nitrogen in the urine is often higher than was found by Minkowski and by Lusk in the animals studied by them. This is attributed to the proteid sparing action of the fat. This sparing action leads to a retention of the nitrogenous portion of the proteid molecule, whilst the part which gives rise to sugar is not retained.

W. D. H.

**Does Dextrose arise from Cellulose in Digestion?** By GRAHAM LUSK (*Proc. Amer. Physiol. Soc.*, 1902; *Amer. J. Physiol.*, 6, xiii).—In phloridzin diabetes, if dextrose is given, it is quantitatively eliminated in the urine. Since cellulose given in such a case does not increase the dextrose of the urine, it follows that dextrose is not produced from cellulose during digestion.

W. D. H.

**Physiological Importance of Pentosans.** By JOSEF KÖNIG and FR. REINHARDT (*Zeit. Nahr. Genussm.*, 1902, 5, 110—116).—After feeding on pentosans, the urine contains only traces of furfuroids.

They appear also to have a 'sparing' effect on metabolism, and are therefore regarded as valuable from the nutritive standpoint.

W. D. H.

**Utilisation of Sugars (Bihexoses) in the Organism.** By ALBERT CHARRIN and BROCARD (*Compt. rend.*, 1902, 134, 188—190. Compare this vol., ii, 216).—When different bihexoses are simultaneously ingested into omnivorous animals accustomed to an amylaceous diet, it is found that maltose is more readily hydrolysed than either lactose or sucrose. On comparing lactose and sucrose, it is found that lactosuria is less frequent than sucrosuria in animals having a milk diet, whilst the converse is true of animals consuming large quantities of sucrose. The facility with which these sugars are hydrolysed depends on the habitual diet; it is the alimentation which makes the ferment.

When very excessive doses of a bihexose are administered, the urine is found to contain this sugar and also the products of its hydrolysis.

G. T. M.

**Action of Alcohol as a 'Proteid-Sparer.'** By RUDOLF ROSEMAN (*Pflüger's Archiv*, 1902, 89, 178—210).—Polemical against R. O. Neumann (compare this vol., ii, 154).

W. D. H.

**Action of Alcohol on Muscle.** By FREDERIC S. LEE and WILLIAM SALANT (*Proc. Amer. Physiol. Soc.*, 1902; *Amer. J. Physiol.*, 6, xiii—xiv).—The experiments were made on frogs; the alcohol was given subcutaneously, and one gastrocnemius muscle was protected from the action of the drug and compared with the other. One to 4 minims of 10 per cent. alcohol per gram of frog increases muscular work by 10 per cent. Less than this has no effect; larger quantities are harmful.

W. D. H.

**Decomposition of Guanidine in the Animal Body.** By ERNST POMMERENIG (*Beitr. chem. Physiol. Path.*, 1902, 1, 561—566).—Guanidine is highly toxic. Doses smaller than poisonous ones are in rabbits excreted unchanged in the urine. Guanidine does not appear to be a normal oxidation product of arginine in the body.

W. D. H.

**Arsenic in the Animal Organism.** By KARL CERNÝ (*Zeit. physiol. Chem.*, 1902, 34, 408—416).—Like Hödlmoser (*Abstr.*, 1901, ii, 673), the author finds that Gautier's statement that arsenic is a normal and important constituent of various parts of the body is incorrect. Sometimes minimal traces are found which have no physiological significance.

W. D. H.

**Florence's Crystals.** By N. BOCARIUS (*Zeit. physiol. Chem.*, 1902, 34, 339—346).—The crystals first described by Florence as obtainable from spermatid fluid are now shown to be due to the presence of choline.

W. D. H.

**Amount of Iodine in Sheep's Thyroid.** By JAC. WOHLMUTH (*Chem. Centr.*, 1902, i, 327; from *Centr. Physiol.*, 15, 587—588).—Hungarian sheep, like those examined by Baumann, have in their



thyroids, iodothylin, which contains 3·2 to 3·3 per cent. of iodine. This is regarded as important, as the districts from which the sheep gathered food are far from the sea.

W. D. H.

**Silicic Acid in the Tissues**, especially in the Whartonian Jelly. By HUGO SCHULZ (*Pflüger's Archiv*, 1902, 89, 112—118).—The amount of silicic acid is higher in the same tissues in youth than in old age. It is highest of all in the embryonic connective tissues, such as the Whartonian jelly.

W. D. H.

**Relation between Spleen and Pancreas**. By LEO F. RETTGER (*Proc. Amer. Physiol. Soc.*, 1902; *Amer. J. Physiol.*, 6, xiv).—Spleen extracts, both *in vitro* and *in vivo*, increase the proteolytic power of pancreatic extracts. Other fluids intravenously injected (saline solution, boiled extracts of spleen, extracts of liver, pancreas, &c.) have no specific 'trypsinogenic' effects.

W. D. H.

**The Mechanism of the so-called Peripheral Reflex Secretion of the Pancreas**. By WILLIAM M. BAYLISS and ERNEST H. STARLING (*Centr. Physiol.*, 1902, 15, 682—683).—The secretion which the pancreas pours out as the result of the application of acid to the intestinal wall occurs when all connections with the central nervous system are severed, and is therefore regarded as a reflex, having its centre in the ganglia of the solar plexus (Wertheimer and Lepage). It is now shown that it also occurs when all connections with the solar plexus are cut through. It must therefore be due to chemical stimulation of the pancreatic cells. The specific irritant is not the acid, as injection of 0·4 per cent. hydrochloric acid has no effect. It is something (a 'secretin') which is produced by the acid acting on some substance (prosecretin) in the mucous membrane of the duodenum and jejunum. If the mucous membrane is rubbed up with the acid, and the filtered product is injected, there is an immediate flow of the juice. The injection also produces a rise of blood-pressure. The substance which produces this effect is not the secretin, for extracts of the ileum similarly prepared have no action on the pancreatic secretion, but nevertheless produce a rise of blood-pressure.

The extract of jejunum produces its effect on secretion after the separation of all proteids. Secretin is soluble in alcohol or ether, and is probably a substance of small molecular weight. Further chemical examination of this material is in progress.

It is suggested that this observation may be the precursor of the discovery of other secretins in the body, and that Pawloff's work on the secretory action of the vagus nerve on the pancreas will need revision.

W. D. H.

**Diuresis**. By JOHN T. HALSEY (*Proc. Amer. Physiol. Soc.*, 1902; *Amer. J. Physiol.*, 6, xvi—xvii).—Nussbaum's results on urinary secretion in frogs are confirmed. The tubular epithelium excretes urea and certain salts. Under the influence of theobromine or phloridzin, it has the power of excreting sugar also.

W. D. H.

**Saline Diuresis.** By ARTHUR R. CUSHNY (*Proc. Amer. Physiol. Soc.*, 1902; *Amer. J. Physiol.*, 6, xvii—xviii).—Sodium sulphate given intravenously causes more profuse diuresis than does the chloride. Magnus and also Sollman consider this is because the sulphate stimulates the secretory elements of the kidney. A simpler explanation is given here on Ludwig's theory, namely, that the sulphate is not so readily absorbed by the renal tubules as the chloride, and so retains a larger amount of water. W. D. H.

**Excretion of Phosphoric Acid in Flesh and Vegetable Feeders.** By W. BERGMANN (*Chem. Centr.*, 1902, i, 219—220; from *Arch. exp. Path. Pharm.*, 1901, 47, 77—81).—If dogs which usually excrete the excess of phosphoric acid in the food by the urine are given calcium also, the excess of the acid appears principally in the faeces. This is due to non-absorption, for if sodium phosphate is injected subcutaneously, the phosphoric acid is excreted by the kidneys whether calcium is given at the same time or not. In herbivora (sheep), subcutaneously injected phosphoric acid is completely excreted by the intestine. If glycerophosphoric acid is given hypodermically, it appears as inorganic phosphate in the urine of the dog but in the faeces of the sheep. W. D. H.

**Excretion of Lithium.** By C. A. GOOD (*Proc. Amer. Physiol. Soc.*, 1902; *Amer. J. Physiol.*, 6, xx—xxi).—Lithium chloride was given to cats hypodermically; 0.5 gram is fatal in about a week. Considerable amounts are obtainable from the stomach, bowel, and saliva, but when small doses are given repeatedly more is excreted in the urine than by the alimentary tract. W. D. H.

**Allantoin Excretion.** By LAFAYETTE B. MENDEL (*Proc. Amer. Physiol. Soc.*, 1902; *Amer. J. Physiol.*, 6, xiv—xv).—Finely minced thymus gland mixed with water was introduced *per rectum* into dogs. The absorption of purine compounds was demonstrated by a rise in the allantoin and uric acid of the urine. Vegetable nucleates and nucleic acid prepared from wheat resemble the nucleo-proteids from animal tissues in metabolism, giving rise, in cats fed on them, to allantoin in the urine. W. D. H.

**A Crystalline Urinary Albumose.** By ALIDE GRUTTERINK and CORNELIA J. DE GRAAFF (*Zeit. physiol. Chem.*, 1902, 34, 393—407).—A case of albumosuria is described; the proteid in question, as in so many of these cases, does not appear to be identical with any known albumose. By a modification of the ammonium sulphate method, it was obtained in a crystalline form, but other salts may also be employed. W. D. H.

**Chemical Composition of Biliary Calculi.** By ANGIOLO FUNARO (*L'Orosi*, 1901, 24, 361—364).—The author gives the following analyses of two samples of biliary calculi removed from women subjected to cholecystotomy.

Cholesterol (and a little fatty matter), 90.87 and 90.08; water (at

100°), 4.60 and 4.50; bilirubin (chloroform extract), 0.81 and 0.19; biliverdin (alcoholic extract), 2.24 and 1.58; mineral matter, 0.88 and 2.72; soluble organic matter (gum, &c.), 0.14 and 1.53. Totals (1) 99.54 and (2) 100.60. The percentages of soluble mineral matter in the two cases were 0.71 and 0.45 and the total phosphoric acid, 0.203 and 0.997.  
T. H. P.

**Phloridzin Diabetes.** By OTTO LOEWI (*Chem. Centr.*, 1902, i, 363—364; from *Arch. exp. Path. Pharm.*, 1901, 47, 48—55; 56—67).—The glycosuria produced by feeding on phloridzin is less intense than that caused by hypodermic or intravenous injection of that drug; this is simply because phloridzin is not wholly absorbed in the alimentary canal, but part passes out with the faeces.

The simultaneous administration of camphor and phloridzin causes the amount of sugar in the urine to be slightly lessened; this will not account for the large amount of camphor-glycuronic acid which appears. Probably, therefore, the source of the sugar and the glycuronic acid in the body is different.  
W. D. H.

**Proteid Metabolism in Fever.** By S. WEBER (*Chem. Centr.* 1902, i, 219; from *Arch. exp. Path. Pharm.*, 1901, 47, 19—47).—Sheep were infected with a febrile disease, and at the same time given abundant nourishment; in the first experiment, the daily intake of nitrogen was 1.36 grams, and the output 1.1 grams. In the second experiment, the numbers were 7.8 and 4.7 respectively; in the latter case, lactose was added to the food. It is thus possible to obtain a putting on of proteid even during fever.  
W. D. H.

**Metabolism in a Case of Lymphatic Leucæmia.** By YANDELL HENDERSON and C. H. EDWARDS (*Proc. Amer. Physiol. Soc.*, 1902; *Amer. J. Physiol.*, 6, xxii).—The uric acid and phosphates were found rather below than above the normal. It therefore appears, as Milroy and Malcolm stated, that the nuclein metabolism of leucæmia differs from that produced by injecting nuclein, and depends, not on an increased formation of leucocytes, but on their diminished katabolism.  
W. D. H.

**Leucocytosis following Intravenous Injections of Sodium Cinnamate.** By H. BATTY SHAW (*J. Path. Bact.*, 1902, 8, 70—81).—Richter and Spiro's observations on the general leucocytosis produced by sodium cinnamate are confirmed; the present experiments were made on cats. The effect is not produced by a loss of water in the blood. The simpler lymphocytes are stimulated to transformation into polymorpho-nuclear and intermediate forms. The spleen does not appear to aid or hinder the change. Eosinophile cells are diminished. Ether has a similar, although not so marked, effect.  
W. D. H.

**Toxic and Antitoxic Action in Vitro and in Corpore.** By ERNEST F. BASIFORD (*J. Path. Bact.*, 1902, 8, 52—69).—Differences between the interaction of toxins and antitoxins as it occurs in the body and outside of it are pointed out. It is suggested

that the action *in vitro* should be termed pseudoantitoxic, as the poison is there incapable of leading to the production of an antitoxin.

W. D. H.

**The Poison of the Daboia Russellii.** By GEORGE LAMB and WILLIAM HANNA (*J. Path. Bact.*, 1902, 8, 1—33).—Daboia venom owes its toxicity mainly, if not entirely, to its action on the blood. It causes rapid death from intravascular clotting, whilst in chronic cases there is a marked deficiency of blood coagulability, to which condition hæmorrhages, which are frequent, are probably due. The poison loses its activity by heating it to 73° for 3 hours, if a weak solution (0·1 per cent.) is used; the toxicity is lessened, but not destroyed, by such treatment if a strong (1 per cent.) solution is employed.

Daboia venom contains no substance comparable to the tox-albumose of cobra venom, and the latter contains no substance which causes intravascular coagulation. Calmette's serum has no power to neutralise the toxin of daboia venom.

W. D. H.

**Toxicology of Selenium and its Compounds.** By I. O. WOODRUFF and WILLIAM J. GIES (*Proc. Amer. Physiol. Soc.*, 1902, *Amer. J. Physiol.*, 6, xxix—xxx).—Selenium is much more toxic than tellurium, although its poisonous effects are qualitatively much the same, and further resemble those produced by arsenic.

Four mg. of a selenite or selenate per kilo. of body weight in dogs kills in a few minutes. The element itself, when given by the mouth, is discharged *per rectum* and does no harm. The introduction of soluble salts is quickly followed by elimination in breath and urine. The distribution of selenium between the organs is similar to that of tellurium.

W. D. H.

**The Poison of Toads.** By FR. PRÖSCHER (*Beitr. chem. Physiol. Path.*, 1902, 1, 575—582).—The poisonous secretion of the toad's skin is present also to some extent in the blood. It is termed *phrynolysin*. It possesses hæmolytic properties, especially on sheep's blood, but has no such action on toad's blood. Other animals are intermediate between these two extremes. Like other lysins, it appears to consist of two substances. Normal rabbits' serum contains no antitoxin to this material, but one appears during the process of immunisation produced in the usual way.

W. D. H.

**Zygadenus Venenosus (Poison Camass).** By REID HUNT (*Proc. Amer. Physiol. Soc.*, 1902; *Amer. J. Physiol.*, 6, xix—xx).—Both the chemical and physiological properties of the active principle of *Zygadenus venenosus* agree very closely with those of veratrine. It is excreted rapidly in the urine, and is absorbed rather slowly from the stomach. By diuretics, it may be removed from the circulation so rapidly that few poisonous symptoms result.

W. D. H.

**Immune Substances.** By ERNST P. PICK (*Beitr. chem. Physiol. Path.*, 1902, 1, 445—471).—A further attempt, in the main unsuccessful, to identify the immune substances with various proteids of the



serum. The experiments chiefly relate to the coagulins of anti-typhoid serum, and are principally concerned with the action of various reagents (acids, alkalis, digestive ferments, &c.) on the coagulin and agglutinin; the principal conclusion arrived at is that agencies which affect, even in a slight degree, the properties of the proteids, lessen or annul the characteristic properties of the substances in question.

W. D. H.

**Putrefaction of Corpses.** By LUDWIG SCHMELCK (*Chem. Zeit.*, 1902, 26, 11).—An analysis of water found in an exhumed coffin which had been buried for about 50 years. Of the body there only remained the skeleton and some *débris* of clothing. The result was as follows: Residue, 0.404; after ignition, 0.303; calcium sulphate, 0.209; calcium phosphate, 0.024; calcium carbonate, 0.023; sodium chloride, 0.027 gram per litre. Oxygen consumed (Kubel's process), 0.0043 gram per litre, and ammonia and nitric acid undetectable. No odour was noticed on removing the lid. The bacteriological investigation has not been concluded.

L. DE K.

## Chemistry of Vegetable Physiology and Agriculture.

**Composition of the Proteids and Cell-membranes in Bacteria and Fungi.** By K. S. IWANOFF (*Beitr. chem. Physiol. Path.*, 1902, 1, 524—537).—The proteids and cell-membranes were separated by Krawkoff's method. The proteids are nucleo-proteids, containing in bacteria nitrogen 16.3, and phosphorus from 1.8 to 2.2 per cent. In fungi, the percentage of nitrogen in the nucleo-proteid is 15.1 to 16.2, and of phosphorus 0.7 to 1. This accords with recent microscopic observations which have shown the presence of nuclear material in these cells. The existence in the cell-membranes of chitin apparently identical with animal chitin is confirmed.

W. D. H.

**Bacteria which Hydrolyse Albumin.** By OSKAR EMMERLING and O. REISER (*Ber.*, 1902, 35, 700—702).—The exact action of *Bacillus fluorescens liquefaciens* on proteid substances is not yet known with certainty; the microbe may be one of the putrefaction bacteria, or it may contain an enzyme related either to pepsin or trypsin. The organism rapidly attacks ordinary gelatin in 10 per cent. solution, particularly at the surface of the liquid, and in order to facilitate the hydrolysis the mixture is often stirred. After several months, the liquid has a strong ammoniacal odour, about 25 per cent. of the nitrogen in the gelatin having been eliminated as ammonia. In spite of the prolonged interaction, the solution contains an appreciable amount of peptones, gases are not evolved, and phenols, indole, skatole, hydrogen sulphide, and diamines, the characteristic products of putrefaction, are not present. Methylamine, trimethylamine, choline, and betaine were,

however, identified in the solution; this result indicating that the bacillus is neither a putrefactive bacterium nor a producer of poisonous ptomaines; it appears to peptonise the proteids, and then slowly degrade the products of hydrolysis to simple monoamines.

The proteolytic action of the bacillus on blood fibrin suspended in water containing toluene is very slow, and the mixture contains a considerable amount of peptone, even after prolonged treatment; arginine, leucine, and aspartic acid were distinguished in the product, this result indicating that the bacillus contains an enzyme resembling trypsin. The action, however, is very slow and incomplete, and resembles that induced by papayotin.

Sucrose, maltose, lactose, amygdalin, and  $\alpha$ - and  $\beta$ -methylglucoside are not attacked by *Bacillus fluorescens*; malic acid is converted into fumaric acid, and carbamide is slowly hydrolysed, but the ammonia liberated kills the organism. A sugar reducing Fehling's solution and forming phenylglucosazone is obtained from old cultures of the bacillus in malt infusions; starch and trehalose are slowly hydrolysed by the microbe.

G. T. M.

**Immunisation against Immune Serum.** By E. W. AINLEY WALKER (*J. Path. Bact.*, 1902, 8, 34—51).—A bacterium may be immunised against its immune serum, and thereby becomes more virulent and less agglutinable, if it is of an agglutinable variety. The immune serum in which its own bacillus has been grown is rendered less agglutinative and less protective against that bacillus. Agglutinins are true anti-substances. The basis of bacterial virulence and of chemiotactic influence is identical, and constitutes that group which causes the production of the immune substance. An animal may be immunised against an immune serum; it is then less capable of being protected by that serum, but its susceptibility to the attack of the bacterium is not increased. The immune substance is not identical in different animals for the same bacterium, but exhibits a specialism to the species.

W. D. H.

**Osmotic Exchanges.** By ALEXANDER NATHANSOHN (*Chem. Centr.*, 1902, i, 325—326; from *Ber. deutsch. botan. Ges.*, 19, 509—513).—Experiments with solutions of salts and non-electrolytes on the osmotic exchanges through the membranous walls of certain marine algæ.

W. D. H.

**Nitrogen Supply and Proteid Formation in Plants.** By FRIEDRICH CZAPEK (*Beitr. chem. Physiol. Path.*, 1902, 1, 538—560).—The gist of the paper is the importance of amino-compounds in the synthesis of proteids in plants.

W. D. H.

**Can Leucine and Tyrosine serve as Nutrients for Plants?** By ERNST SCHULZE (*Landw. Versuchs-Stat.*, 1902, 56, 293—296. Compare this vol., ii, 165).—After referring to Overton's statement (*Vierteljahresschr. Naturforsch. Ges. Zürich*, 1899, 44) that amino-acids belong to those substances which hardly appreciably enter into the living protoplasm, the author quotes some of his earlier results,

which seem to exclude the possibility of the leucine having been assimilated after decomposition (*Zeit. physiol. Chem.*, 1886, 10, 134, and 1892, 17, 513).

Glutamic acid (inactive) is assimilated by *Penicillium glaucum*. The residue recovered from the solution was found to be optically active. N. H. J. M.

**Changes in Nitrogenous Substances during the Ripening of some Cereals.** By N. K. NEDOKUTSCHAEFF (*Landw. Versuchs-Stat.*, 1902, 56, 303—310).—Determinations of dry matter, and of total nitrogen, and nitrogen in the forms of proteids, asparagine, and amides, were made in the grain of rye, wheat, barley, and oats at six different periods. It was found that whilst the percentage of proteid nitrogen increases as ripening proceeds, the nitrogen in other forms, especially asparagine, diminishes. The percentage of total nitrogen diminishes in wheat and rye, but increases in oats and barley. N. H. J. M.

**Ripening of Apples.** By RICHARD OTTO (*Bied. Centr.*, 1902, 31, 107—108; from *Proskau. Obstbau-Zeit.*, 1901).—Analyses were made of apples taken from the trees at intervals of fourteen days and of similar apples after being stored.

The percentage of water increased during ripening. The starch diminished from 3.99 (Sept. 7) to 1.60 (Oct. 5), and disappeared altogether when the apples were stored; the ash in the dry matter decreased, whilst the cellulose remained constant. As regards nitrogen, there was an increase during ripening on the trees, but afterwards a decrease.

The sp. gr. of the must, and the amounts of total sugar and glucose increased. The sucrose in the must increased during the ripening of the apples, but diminished in the case of stored apples. The acidity diminished both before and after the apples were taken off the trees. The amount of non-sugar reducing Fehling's solution in the must is small, and decreases during ripening. N. H. J. M.

**Examination of Asparagus Seeds.** By W. PETERS (*Arch. Pharm.*, 1902, 240, 53—56).—Seeds of *Asparagus officinalis* were found to contain water 11.5, woody fibre 8.2, nitrogen 3.0, and oil 15.3 per cent. Starch was not found, but there was *reserve-cellulose* (mannan); this was converted by boiling with 6 per cent. hydrochloric acid into *d*-mannose (seminose, Reiss, Abstr., 1889, 687), which was isolated and identified in the form of its phenylhydrazone; the seeds yielded 37.5 per cent. of mannose.

The oil was reddish-yellow in colour, and is a drying oil. It had sp. gr. 0.928 at 15°, and the refractometer indication in the Zeiss refractometer was 75 (1.75) at 25°. The saponification number was 194.1; the iodine number, with eighteen hours' digestion, 137.1; the acetyl-acid number, 179.2; the acetyl-saponification number, 204.4. The oil was found to consist of the glycerides of palmitic, stearic, oleic, linolic, linolenic and *isolinolenic* acids; these were liberated by hydrolysing the oil with potash, and the last four were identified by the products they yielded on oxidation with alkaline permanganate,

namely, dihydroxystearic, tetrahydroxystearic (sativic), linusic, and isolinusic acids respectively. C. F. B.

**The Fatty Oil of Semen Coccognidii.** By W. PETERS (*Arch. Pharm.*, 1902, 240, 56).—The seeds contain 36—37 per cent. of a drying oil, with sp. gr. 0.924 at 15°, saponification number 196—197, iodine number (after eighteen hours' digestion) 125.9—126.3, acetyl-acid number 191.5, acetyl-saponification number 209.1. Palmitic, stearic, oleic, linolic, linolenic, and isolinolenic acids were obtained from it. C. F. B.

**Carbohydrates Present in the Seed of Phellandrum Aquaticum.** By CHAMPENOIS (*J. Pharm. Chim.*, 1902, [vi], 15, 228—233. Compare *Abstr.*, 1900, ii, 301).—The fruit of *Phellandrum aquaticum* contains 0.426 per cent. of sucrose. Arabinose and galactose were identified as the chief products of the partial hydrolysis of the fruit. The insoluble residue from this hydrolysis was submitted to the Braconnot-Flechsig method of hydrolysis, when mannose and pentoses were found amongst the products of such action. H. R. LE S.

**Chemistry of Solanum Chenopodium.** By C. EDWARD SAGE (*Pharm. J.*, 1902, [iv], 14, 174).—The leaves and fruits of *Solanum chenopodium* contain 0.15 per cent. and the stalks 0.07 per cent. of total alkaloid; the purified alkaloid gives the reactions of solanine. E. G.

**Phytochemical Examination of Verbascum Sinuatum** (used to poison Fish) and some other Scrophulariaceæ. By L. ROSENTHALER (*Arch. Pharm.*, 1902, 240, 57—69).—The half-ripe fruits were freed from fat and chlorophyll by treatment with ether, extracted with boiling water, the extract mixed with magnesium oxide and evaporated to dryness, the powdered residue extracted with alcohol, and the alcoholic extraction precipitated fractionally with ether. A substance was thus obtained with the properties of a saponin, but peculiar in that it is soluble in cold absolute alcohol and its solution gives no precipitate with saturated aqueous barium hydroxide or with lead acetate solution.

*Verbascum-saponin* is a white, amorphous powder, optically inactive, and having the composition  $C_{17}H_{26}O_{10}$ , probably  $C_{68}H_{84}O_{20}(OH)_{20}$ . When heated with acetic anhydride and sodium acetate, it forms an amorphous acetyl derivative,  $C_{68}H_{84}O_{20}(OAc)_{20}$ . When heated at 150° with benzoic anhydride and sodium benzoate, it forms a somewhat crystalline benzoyl derivative,  $C_{68}H_{84}O_{20}(OH)_8(OBz)_{12}$ . It can be hydrolysed by boiling with 8 per cent. hydrochloric acid, when *verbascum-sapogenin* is precipitated and dextrose remains in solution; the two together correspond with only 94 per cent. of the saponin, however. The sapogenin can be crystallised from alcohol, and has the composition  $C_5H_8O$ ; the glucose was identified by means of its phenylosazone.

No alkaloid could be detected in the fruits of *Verbascum sinuatum* or *V. phlomoides* (including *V. thapsiforme*), or in the seeds of *V. nigrum* or *V. Thapsus*. Saponin could not be detected in the fruits of *Paulownia*



*imperialis*, *Gratiola officinalis*, *Antirrhinum majus* or in the officinal *Flor. Verbascum*. In the fruits of *Verbascum phlomoides* (incl. *thapsi-forme*), a substance with some of the properties of a saponin was obtained.

It was discovered incidentally that some organic substances are precipitated along with lead sulphide, and cannot be extracted from the precipitate with alcohol, but are set free when the sulphide is just oxidised to sulphate by the addition of hydrogen peroxide. This may be useful in separating such substances from mixtures. C. F. B.

**Is the Form of Cereal Plants influenced by Nitrogenous Manures?** By H. CLAUSEN (*J. Landw.*, 1902, 49, 365—388).—Nitrogenous manures tend to increase the length of the lower portions of the stems of cereals, whilst the upper portions are relatively shortened. Nitrates have far more effect than ammonium salts. The lengthening of the lower parts of the stems renders them weaker and less able to stand. Although ammonium salts produce more grain than nitrates, the crop is less liable to be laid than when nitrates are employed. N. H. J. M.

**Cultivation of Lucerne on Soils without Calcium Carbonate.** By PIERRE P. DEHÉRAIN and EM. DEMOUSSY (*Compt. rend.*, 1902, 134, 75—80. Compare this vol., ii, 167).—Lucerne was sown in 1900 on heath soil, containing much organic matter, and in 1901 on a soil from Brittany derived from gneiss. Both soils were free from calcium carbonate.

The heath soil contained a limited number of nodule-bacteria and produced comparatively few nodules on the roots of the plants. The nodules were mostly branched. Addition of calcium carbonate (10 per cent.) greatly increased the production of nodules and more than doubled the yield of lucerne. Garden soil alone (10 per cent.) had a very much greater effect than calcium carbonate and its addition to the soil resulted in the production of single nodules. Simultaneous addition of garden soil and calcium carbonate slightly increased the yield as compared with garden soil alone.

The soil derived from gneiss also contained bacteria which produce root nodules. Unlike clover (*loc. cit.*), lucerne grown on this soil was very little benefited by addition of calcium carbonate. Garden soil, however, doubled the yield of lucerne. The effect of inoculation with garden soil on the form of the nodules was very marked. The original soil bacteria produced mainly branched nodules, whilst under the influence of the garden soil bacteria the majority of nodules were single. Calcium carbonate, both alone and with garden soil, slightly increased the number of single nodules. N. H. J. M.

**Production of Arrowroot.** By E. LEUSCHER (*Zeit. öffentl. Chem.*, 1902, 8, 23—25).—The cultivation of *Maranta* and the preparation of arrowroot are described. The average percentage composition of the roots grown in Jamaica was found to be as follows:

Water.	Starch.	Dextrin and sugar.	Crude fibre.	Ether. extract.	Proteid.	Ash.
63.42	27.84	2.08	3.94	0.19	1.64	0.89

The ash consists chiefly of phosphoric acid and potassium carbonate. The pulped root, when steam distilled, yields a volatile oil.

N. H. J. M.

Cassava. By E. LEUSCHER (*Zeit. öffentl. Chem.*, 1902, 8, 10—11).—The yield of cassava roots on well irrigated land may be more than 32,000 lbs. per acre. The percentage composition of the roots (mean of six analyses) is as follows :

Water.	Starch.	Nitrogenous matter.	Crude fibre.	Sugar.	Ether extract.	Ash.
70·25	21·44	1·12	1·11	5·13	0·41	0·54

N. H. J. M.

Sand Culture Experiments with Kohlrabi on the Manures which influence the Production of Heads. By RICHARD OTTO (*Bied. Centr.*, 1902, 31, 99—100; from *Bot. Centr.*, 1901, 86, 33).—All the pots received, per 1 kilo. of sand, potassium nitrate (1 gram), sodium chloride (0·5 gram), calcium sulphate (0·5 gram), magnesium sulphate (0·5 gram), tricalcium phosphate (0·5 gram), and ferric hydroxide (0·2 gram). The pots of series 2, 3, 4, and 5 had, in addition : (2 and 3), 5·65 and 11·3 grams of potassium chloride ; (4 and 5), 5·65 and 11·3 grams of disodium hydrogen phosphate. The best results were obtained in series 1, the amounts of extra manures of the other series being excessive. Very little growth was obtained in series 4 and 5.

N. H. J. M.

Phosphoric Acid in Wines. By G. PATUREL (*Ann. agron.*, 1902, 28, 5—30).—Vines remove comparatively small amounts of phosphoric acid from the soil, and the greater portion of it is returned with the leaves and marc, &c. The phosphoric acid in wine amounts to about 3 kilos. per hectare.

Phosphatic manuring is, however, of importance both as regards the maturation and the quantity of the grapes, and it enables the grapes to resist cryptogamic diseases.

Muntz's observations that a relation exists between the value of wines and the amount of phosphoric acid they contain is confirmed. Most of the phosphoric acid of red wines is derived from the juice, and very little from the solid portions of the grapes ; these lose, however, an appreciable amount of phosphoric acid during fermentation.

N. H. J. M.

Nitrogenous Manuring of Vines. By PAUL WAGNER (*Bied. Centr.*, 1902, 31, 87—88; from *Hess. landw. Zeits.*, 1901, 382).—When 600 cwt. of dung is applied every three years, it is proposed that sodium nitrate should be applied each year, the total amounts of nitrate (in two applications) increasing from 400 kilos. the first year to 600 kilos. the third year. Instead of sodium nitrate (first application of 200 to 400 kilos.), ammonium sulphate (150—300 kilos.) may be used.

When no dung is employed, 700 kilos. of sodium nitrate are applied ;

400 kilos. (or 300 kilos. of ammonium sulphate) for the first and 300 kilos. for the second dressing. N. H. J. M.

**Molasses Foods.** By C. V. GAROLA (*Ann. agron.*, 1902, 28, 111—112; from *J. d'agric. prat.*, 1901, ii, 406).—Peat molasses containing 24 per cent. of peat and 76 per cent. of molasses had the following composition: water, 19.00; sugar, 31.70; soluble matters, 20.93; insoluble, 19.46; and ash, 8.91 per cent. Good results were obtained by feeding horses with the food.

A suitable food was prepared by mixing molasses (45 parts), sesamé cake (27.5 parts), and ground earth-nut husks (27.5 parts).

N. H. J. M.

**Dried Brandy Residues.** By KARL DIETRICH (*Landw. Versuchs-Stat.*, 1892, 56, 321—366).—Results of analyses of grains, potatoes, the residuary liquors, and the dried residues by various investigators.

N. H. J. M.

**New Problems in Soil Inoculation.** By JULIUS STOKLASA (*Bied. Centr.*, 1902, 31, 76—80; from *Zeit. Landw. Versuchs-wes. Oesterr.*, 1900, 10).—The results of experiments in which bone-meal, with nutritive solutions, was inoculated with various microbes (*Bacillus megatherium*, *B. fluoresc. liq.*; *B. proteus vulg.*; *B. butyricus Huppe*; *B. mycoides*, and *B. mesentericus vulgatus*) showed in every case a very considerable production of amides as well as an increase in the soluble phosphoric acid.

In the next series of experiments, oats were grown in soil (not sterilised) manured with bone-meal, without inoculation, and inoculated with the same microbes. Inoculation was in every case beneficial, but the greatest yields of oats were obtained under the influence of *Bacillus megatherium* (or alinit) in presence of xylose. The results of the pot experiments were all in accordance with those of the bone-meal inoculation experiments. The least satisfactory results were obtained with *B. fluorescens liquefaciens*.

N. H. J. M.

**Soils suitable for Chestnuts.** By L. PICCIOLI (*Bied. Centr.*, 1902, 31, 75—76; from *Staz. Sper. Agrar. Ital.*, 1901, 745).—From the examination of the soils and subsoils of Italian chestnut forests, the conclusion was drawn that chestnuts require a moderate amount of lime, but that as much as 8 per cent. of lime is very injurious. Application of potassium neutralises to some extent the injurious action of lime.

It is not usual to manure chestnut forests. The author recommends manuring with superphosphate (3 cwt.), gypsum (2 cwt.), ammonium sulphate (1 cwt.), and potassium sulphate (1—5 cwt. per hectare).

The most suitable soils are those derived from trachyte, leucite, or basalt, and those from granite, syenite, and porphyry containing a little clay.

N. H. J. M.

**Nitrogen of Humus.** By A. DOJARENKO (*Landw. Versuchs-Stat.*, 1902, 56, 311—320).—The total nitrogen and the nitrogen in the form of amides, ammonia, and amino-acids was determined in humic acid from

five black soils (1—5), from a sandy black soil (6), and from a loamy black soil (7). The percentage amounts of nitrogen in the dried substance were found to be as follows :

	Total.	Nitrogen per cent. in the dried substance.		
		As amino-acids.	As amides.	As ammonium.
1. Black soil (Nischni) .....	2.74	1.34	0.31	0.04
2. „ (Tula) .....	3.38	1.81	0.41	0.08
3. „ (Samara) .....	2.64	1.30	0.29	0.02
4. „ „ .....	3.33	2.34	0.32	0.03
5. „ (Tula) .....	4.59	1.01	0.48	0.06
6. Sandy black soil (Poltawa) .....	3.65	1.26	0.27	0.07
7. Loamy „ „ (Charkow) .....	4.02	1.96	0.22	0.03

N. H. J. M.

**Mineral in Jamaica Soils.** By E. LEUSCHER (*Zeit. öffentl. Chem.*, 1902, 8, 28—29).—The clay soils and subsoils of Jamaica were found to contain numerous black balls, 2 to 12 mm. in diameter, of the following percentage composition :

Water 105°.	Lost at 105—180°.	CaO.	MgO.	BaO.	MnO <sub>2</sub> .	Mn <sub>2</sub> O <sub>3</sub> .	Fe <sub>3</sub> O <sub>4</sub> .
15.50	7.55	0.52	0.29	1.15	20.02	2.71	19.09
	Al <sub>2</sub> O <sub>3</sub> .	Ni <sub>2</sub> O <sub>3</sub> .	CuO.	P <sub>2</sub> O <sub>5</sub> .	S.	Insoluble.	
	7.22	0.40	0.14	0.55	trace	24.86.	

The mineral contains, therefore, 14.75 per cent. of manganese and 13.6 per cent. of iron.

The amount of the mineral decreases with the depth, and only isolated balls occur below 2 metres. The soil produces good tobacco, and bananas and beans grow luxuriantly on it.

N. H. J. M.

**Green Manuring.** By OTTO PITSCH (*Ann. agron.*, 1902, 28, 59—61; from *J. d'agric. prat.*, 1901, i, 753 and 756).—The object of the experiment was to ascertain the amounts of total crop and nitrogen yielded by different leguminous plants. It was found that vetches and peas gave greater yields than blue lupins, but that the latter have the advantage that their roots penetrate the soil to a greater depth and thus prepare the subsoil for subsequent crops.

N. H. J. M.

## Analytical Chemistry.

**Modification of Hempel's Gas Analysis Apparatus.** By THEODORE W. RICHARDS (*Zeit. anorg. Chem.*, 1902, 29, 359—364. Also *Proc. Amer. Acad.*, 1901, 37, 201).—The absorption pipette consists of a bulb of about 75 c.c. capacity provided with a narrow stem turned upwards at the bottom and fitted into a bottle containing an absorbing



liquid. The capacity of the bottle should be about double as great as that of the bulb.

The author uses a small burette (50 c.c.) for measuring the volume of the gas, the temperature being kept constant by means of a water-jacket. J. McC.

**Electrolytic Estimation of Iodine in Presence of Bromine and Chlorine.** By ERICH MÜLLER (*Ber.*, 1902, 35, 950—954).—When an alkaline or neutral solution containing various haloid salts is electrolysed, the iodide is quantitatively converted into iodate, which can be estimated by treatment with potassium iodide and titration with thiosulphate. To prevent the reconversion of iodate into iodide, the electrolysis is carried out in the presence of a little potassium chromate, which must be allowed for when titrating. The cathode used was a gauze of platinum wire, 10 cm. long and 0.5 mm. thick, the anode a piece of platinum foil 14 cm. square and platinised on each side; a current of 1 ampere for  $1\frac{1}{2}$  minutes is employed, and the *E.M.F.* must not exceed 1.7 volts or some bromide will be converted into hypobromite. R. H. P.

**Estimation of Hydrofluoric Acid in Aqueous Solutions.** By F. WINTELER (*Zeit. angew. Chem.*, 1902, 15, 33—34).—An improved table showing the relation between the specific gravity at 20° and the strength of hydrofluoric acid.

The table has been constructed by carefully taking the sp. gr. with a platinum hydrometer, and, with the usual precautions, titrating a definite amount of the acid with normal alkali free from carbon dioxide, using phenolphthalein as indicator. Litmus or methyl-orange cannot be employed. L. DE K.

**Analysis of Pyrites and Estimation of Sulphuric Acid.** By GEORG LUNGE (*Zeit. angew. Chem.*, 1902, 15, 73—74).—A reply to Auzenat (this vol., ii, 104). The addition of sodium chloride is superfluous, and there is also no necessity for heating above 100°. The barium sulphate has completely deposited after half-an-hour. Fresh experiments are given in support of this view. L. DE K.

**Precipitation of Sulphuric Acid in Native Potassium Salts.** By ZÖPFCHEN (*Chem. Zeit.*, 1902, 26, 159).—Before proceeding to the estimation of potassium by means of platinic chloride, it is necessary to remove sulphates by addition of barium chloride, any excess of which should be again removed by adding sulphuric acid; as, however, a trace of the latter does not interfere with the estimation, much time may be saved by merely adding barium chloride until precipitation has nearly ceased. L. DE K.

**Reaction of the Phenolsulphonic Reagent in the Determination of Nitrates by Grandval and Lajoux's Colorimetric Method.** By CARLO MONTANARI (*Gazzetta*, 1902, 32, i, 87—96).—The yellow coloration obtained in this test (*Abstr.*, 1885, 1093) has generally been supposed to be due to the formation of picric acid, but

the author shows that the first product of the reaction is probably *o*-nitrophenol, and this, in the presence of nitrates (which yield nitric acid), passes readily into 2 : 4- and 2 : 6-dinitrophenol. T. H. P.

**The Supposed Reaction of Brucine with Nitrous Acid.** By GEORG LUNGE (*Zeit. angew. Chem.*, 1902, 15, 1—3).—The statement made by Winkler (Abstr., 1901, ii, 627); that brucine reacts with nitrous acid as well as with nitric acid is entirely opposed to the author's experience. He has repeated some of his experiments, which again prove that brucine only reacts with nitric acid, not with nitrous acid. If a reaction is obtained with a nitrite, this shows that the nitrous acid has been partly converted into nitric acid; a result that will always happen if the nitrous acid at the moment of its liberation does not come in contact with an excess of strong sulphuric acid so as to form the stable nitrosylsulphuric acid. If the directions given by the author and Lwoff (Abstr., 1894, ii, 398) are carefully followed, nitrous acid cannot be mistaken for nitric acid.

L. DE K.

**Destruction of Organic Matter in the Analysis of Substances containing Phosphorus, Arsenic, and Metals.** By G. MEILLÈRE (*J. Pharm. Chim.*, 1902, [vi], 15, 97—99).—The destruction of the organic matter is effected by heating the substance with a small quantity of potassium sulphate and a mixture of 1 part of sulphuric acid and 4 parts of nitric acid by volume. The method is especially suitable for the estimation of phosphorus, lead, arsenic, mercury, copper, and zinc in the presence of organic matter.

H. R. LE S.

**Detection of Phosphorus in Cases of Poisoning.** By P. E. ALESSANDRI (*L'Orosi*, 1901, 24, 397—407).—The best preliminary test for phosphorus in cases of suspected poisoning is that suggested by Binda, consisting in dipping into the stomach contents, &c., a glass rod, which is then rubbed vigorously on a heated glass plate in a dark place; very minute quantities of phosphorus give a visible phosphorescence. A portion of the material may also be extracted with carbon disulphide, the solution being then evaporated and tested as follows: (1) By phosphorescence as above described. (2) By heating a small quantity of the residue dissolved in either carbon disulphide or alcohol and allowing the vapours evolved to impinge on slides moistened with (a) a nitric acid solution of molybdic acid, and (b) silver nitrate, the slides being afterwards examined under the microscope. (3) By microscopic examination of the residue from the carbon disulphide extract, in order to discover, if possible, small fragments of free phosphorus. (4) By inspection of the flame given by the alcoholic solution of the residue left from the carbon disulphide extract.

T. H. P.

**Detection and Approximate Estimation of Minute Quantities of Arsenic in Beer, Brewing Materials, Food-Stuffs, and Fuel.** By the Conjoint Committee of the Society of Chemical Industry and the Society of Public Analysts [OTTO HEHNER, ALFRED H. ALLEN, ALFRED C. CHAPMAN, CHARLES ESTCOURT, DAVID HOWARD, ARTHUR R.

LING, RUDOLPH MESSEL, and LEONARD T. THORNE] (*Analyst*, 1902, 27, 48—53).—*Procedure without destruction of organic matter*.—Beer is diluted with an equal volume of hydrochloric acid. Of malt, 50 grams are taken and extracted at 50° with a mixture of 50 c.c. of hydrochloric acid and 50 c.c. of water; 20 c.c. of the liquid then contain the arsenic from 10 grams of the sample. Of hops, 20 grams are digested with 100 c.c. of dilute hydrochloric acid (1:1), and 50 c.c. of the strained liquid are used for the test. Of brewing sugars, 10—20 grams are dissolved in water and 10 c.c. of hydrochloric acid added. If sulphites are present, these must be oxidised by bromine, the excess of which is then boiled off. *Destruction of organic matter. Acid method*.—Ten grams of the substance or the residue of 10—20 c.c. of beer are evaporated in a 3½ inch porcelain crucible with 10—15 c.c. of nitric acid on a sand-bath until no more brown fumes are evolved. Three c.c. of strong sulphuric acid are added and the heating continued until the mass begins to char, when another 5 c.c. of nitric acid are added. After completely expelling the acid, the crucible is half filled with water and a few c.c. of hydrochloric or dilute sulphuric acid and the charred mass is extracted for half-an-hour on the water-bath. The filtrate and hot washings are evaporated down to 30 c.c. and should be colourless. When testing hops, these should be gradually added to a mixture of 10 c.c. of nitric and 5 c.c. of sulphuric acid; when half the hops have been introduced, another 5 c.c. of nitric acid are added, when the whole is treated as before. *Basic method*.—Twenty c.c. of beer are evaporated with 1 gram of pure calcium or magnesium oxide; solid materials are mixed with half their weight of the same, and the mixture is incinerated. The ash is then dissolved in dilute acid and tested. The process is however, not recommended for hops. Of coal and other fuel, two portions of 1 gram each are taken, one being ignited without, and the other with, addition of 1 gram of either base. The difference in arsenic between the two determinations represents the volatile arsenic.

The final testing is effected in the Marsh apparatus, for the exact form of which the original article and illustration should be consulted. The arsenical mirrors are compared with those obtained by testing standard solutions containing 0.002, 0.004, 0.006, 0.008, and 0.01 mg. of arsenious acid per 2 c.c. Careful blank experiments should be made to make sure of the complete absence of arsenic in the reagents used.

L. DE K.

**Detection of Arsenic in Hydrochloric and Sulphuric Acids.**  
By E. SEYBEL and H. WIKANDER (*Chem. Zeit.*, 1902, 26, 50).—Five c.c. of hydrochloric acid or sulphuric acid (previously diluted to sp. gr. 1.45) are mixed with a few drops of a concentrated solution of potassium iodide. In the presence of arsenic in either state of oxidation, a yellow colour or turbidity due to arsenic triiodide is formed. If the sulphuric acid should contain lead, a precipitation of lead iodide may be prevented by adding some hydrochloric acid. Some impurities may be present which interfere with the reaction, for instance, free chlorine or ferric chloride in hydrochloric acid, or nitroso-compounds in sulphuric acid. The test will still show 1 part of arsenious acid in 100,000 parts of acid.

L. DE K.

**A Criticism of the Classical Method employed for the Separation of Traces of Arsenic and Antimony.** By LÉONCE BARTHE (*J. Pharm. Chim.*, 1902, [vi], 15, 104—109. Compare Abstr., 1901, ii, 690; this vol., ii, 52).—A critical review of the possible sources of error in the methods usually employed for the separation and estimation of traces of arsenic and antimony. H. R. LE S.

**Analysis of Commercial Copper and Mattes.** By P. TRUCHOT (*Ann. Chim. anal.*, 1902, 7, 58—61. Compare Abstr., 1901, ii, 197, and this vol., ii, 228).—*Estimation of selenium and tellurium.*—Keller's process (precipitation of selenium and tellurium by ammonia in the presence of ferric sulphate), as used in the smelting works in the western United States, is recommended. *Estimation of phosphorus.*—In Keller's process, this will remain in solution after the separation of tellurium, selenium, arsenic, &c., by hydrogen sulphide. After precipitating it by means of ferric chloride in the presence of calcium carbonate, it is finally separated by the molybdic acid process. *Estimation of sulphur.*—One grain of matte or about 5 grams of copper are treated by the method previously described (Abstr., 1900, ii, 309). *Estimation of gold and silver.*—Fifty to 100 grams of the sample of copper or matte are dissolved in 350—700 c.c. of nitric acid of sp. gr. 1.2, the insoluble matter is collected, ignited, and scorified with 5—6 grams of lead and some borax glass. The button of lead is finally cupelled in the ordinary way to obtain a button of gold. The acid filtrate containing the silver is mixed with 3 or 4 c.c. of sodium chloride solution, and the silver chloride so obtained is collected on a filter and incinerated with addition, if necessary, of some sodium hydrogen carbonate. The ash is then subjected to scorification with lead and subsequent cupellation. L. DE K.

**Analyses of Chromates and Manganates.** By W. HERZ (*Ber.*, 1902, 35, 949).—For the quantitative analyses of chromates and manganates, reduction by means of hydrazine sulphate instead of alcohol or hydrogen sulphide is recommended. R. H. P.

**"White Spirit."** By AMBROISE ANDOUARD and P. ANDOUARD (*J. Pharm. Chim.*, 1902, [vi], 15, 99—101).—Oil of turpentine is sometimes adulterated with an American petroleum known as white spirit. Such adulteration will be recognised by the fact that the oil of turpentine will have a blue fluorescence, a low rotatory power, and will not be completely volatile on exposure to air. H. R. LE S.

**Titration of Potassium Ferrocyanide with Potassium Permanganate.** By BRUNO GRÜTZNER (*Arch. Pharm.*, 1902, 240, 69—73).—When potassium permanganate is added to a dilute solution of potassium ferrocyanide, containing only a slight excess of sulphuric acid, in amount equal to about half that required for complete oxidation, a small quantity of a greyish powder is precipitated; this has the composition  $K_2MnFe(CN)_6$ .

If accurate results are to be obtained in titrating a ferrocyanide with permanganate, the concentration of the ferrocyanide in the



solution should be about 0.1 per cent., and plenty of sulphuric acid should be present. The permanganate solution should be standardised against pure potassium ferrocyanide, and in the actual estimation the same shade of colour should be taken to indicate the end-point as in the standardisation.

C. F. B.

**Estimation of Methoxyl Groups in Sulphur Compounds.** By FELIX KAUFLEDER (*Monatsh.*, 1901, 22, 1105—1108).—This method is of use where the methoxyl group can be hydrolysed by potassium hydroxide, and may therefore be used to distinguish between methoxyl groups of esters and of ethers. The methoxy-compound is boiled with aqueous potassium hydroxide, and the alcohol vapour is carried by a current of air over ignited copper sulphate and absorbed in hydriodic acid kept cool by ice. The methyl iodide is afterwards distilled into silver nitrate solution. In this way, the formation of mercaptan in the hydriodic acid is avoided. Determinations with potassium methyl sulphate, dimethyl sulphate, methyl benzenesulphonate, and mono- and dimethyl sulphobenzoate gave good results.

G. Y.

**Mannitic Fermentation of Wine.** By PHILIP SCHIDROWITZ (*Analyst*, 1902, 27, 42—47).—A paper on the injurious effect of the mannitic fermentation of wines, and the means by which it can be avoided. The author estimates the mannitol by the process recommended by Gayon and Dubourg (*Ann. Inst. Pasteur*, 1901, 15, 527), as follows: 50 c.c. of the wine are evaporated on the water-bath to a syrup, with addition of 2—3 grams of sand, and then allowed to remain in a cool place for two or three days, when the mannitol will have crystallised. One hundred c.c. of 85 per cent. alcohol, saturated with mannitol at the temperature of the room, are added with constant stirring, and the whole is drained on a filter for two hours. The filter is then extracted in a Soxhlet apparatus for one hour with 100 c.c. of 85 per cent. alcohol,  $\frac{4}{5}$  of the alcohol is distilled off, the remainder decolorised with a little animal charcoal, filtered, and the residue washed twice with about 50 c.c. of hot 85 per cent. alcohol. The filtrate is evaporated to dryness at 60°, and the residual mannitol is weighed as such. If the wine contains much sugar, it is best to remove this by fermentation, before estimating the mannitol.

Mannitol may be tested for qualitatively by shaking the wine with yellow mercuric oxide, allowing a few c.c. of the filtrate to slowly evaporate, and examining the residue with the microscope. Characteristic fine, silky needles will then be observed.

L. DE K.

**Use of Acid Mercuric Nitrate in the Analysis of Sugar Solutions.** By GUSTAVE PATEIN and ÉMILE DUBAU (*J. Pharm. Chim.*, 1902, [vi], 15, 221—226).—The use of acid mercuric nitrate for decolorising sugar solutions has been objected to on the ground that the nitrate oxidises part of the sugar. It is now shown that if the author's method is followed in detail, the sugar present in the solution suffers no change whatever. A solution of mercuric nitrate, prepared by dissolving yellow mercuric oxide in the calculated quantity of

nitric acid, is mixed with the sugar solution to be decolorised, and a solution of sodium carbonate added until the liquid is no longer acid to litmus paper. The filtrate from this contains the whole of the sugar, together with a trace of mercuric nitrate, which must be removed by means of sodium hypophosphite if the sugar is estimated by means of Fehling's solution.

H. R. LE S.

**Drying of Carbohydrates and Estimation of their Water of Crystallisation.** By ERNST SCHULZE (*Chem. Zeit.*, 1902, 26, 7—8).—The carbohydrate is placed in a glass boat and introduced into a copper tube fixed into a copper trough containing brine or dilute glycerol, and heated at 100°, a current of dry hydrogen being transmitted for about an hour. In the case of raffinose, to prevent fusion, the temperature should at first not exceed 75°. Lactose does not part with all its water at 100°, although it may probably do so by protracted drying. The loss suffered by many carbohydrates, such as stachyose, at a more elevated temperature is not due to true water of crystallisation.

L. DE K.

**Estimation of Starch in Cereals.** By LÉON LINDET (*Ann. Chim. anal.*, 1902, 1, 41—43).—A modification of the author's process for the estimation of starch in cereals (*Abstr.*, 1897, ii, 525).

The ground cereal is treated as before with pepsin and hydrochloric acid, and the separated starch collected in a conical phial and washed by decantation. Instead of weighing the starch as such, it is now proposed to heat it with 100 c.c. of water, containing 0.25, 0.5, or 1 c.c. of sulphuric acid, for one hour at 110°; the acid is then neutralised with sodium hydroxide, and the liquid diluted to 250 c.c. The solution is titrated with Fehling's solution, which gives the amount of starch converted into dextrose; the solution is also examined in the polariscope, and after allowing for the rotatory power of the dextrose, the extra rotation is considered to be due to dextrin, which is then also expressed as starch.

L. DE K.

**Detection of Salicylic Acid in Foods.** By HENRI TAFFE (*Ann. Chim. anal.*, 1902, 7, 18—19).—The mixture of equal volumes of ether and light petroleum formerly proposed by the author is not sufficiently anhydrous and is therefore still capable of dissolving traces of tannins which interfere with the ferric chloride reaction.

It is now recommended to stir in, by means of a glass rod, an extra quantity of light petroleum before pouring off the ethereal layer. Any emulsion may be again treated with a fresh quantity of light petroleum.

L. DE K.

**Detection and Estimation of Methyl Anthranilate.** By ERNST ERDMANN (*Ber.*, 1902, 35, 24—27).—Methyl anthranilate readily yields a diazonium salt which combines with  $\beta$ -naphthol or  $\beta$ -naphtholdisulphonic acid R. The azo-colouring matter produced with  $\beta$ -naphthol is insoluble, and the reaction may be employed in the estimation of the ester in oil of jasmine or oil of neroli. The diazo-solution contained in a burette is run into an alkaline solution containing a known

weight of  $\beta$ -naphthol until a filtered sample neither reacts with the diazo-solution nor with an alkaline solution of the naphthol. Very small quantities of the ester may be thus estimated. The method is also available for mandarin oil, which contains methyl methylantranilate as well as the primary amino-ester; the extract is treated with excess of nitrous acid, the oily nitrosoamine of the secondary amino-ester is removed by means of ether, and the aqueous solution of the diazonium compound examined in the manner indicated.

G. T. M.

### Detection of Drying Oils and Marine Animal Oils in Mixtures.

By GEORGES HALPHEN (*Ann. Chim. anal.*, 1902, 7, 5—8, 54—58).—The reagent used by the author consists of 5 volumes of glacial acetic acid, 1 vol. of nitrobenzene, and  $\frac{1}{2}$  vol. of bromine. One c.c. of the oil is mixed with 15 c.c. of the reagent, and both drying oils and fish oils give an insoluble bromine substitution product. This is collected on a filter, washed with ether, and then well pressed between "Papier Joseph." The dry mass is then heated to a temperature just below boiling with carbon tetrachloride (2.5 c.c. for each 0.1 gram). The precipitate derived from linseed oil dissolves completely, but on cooling it gradually deposits, forming an alumina-like, bulky, gelatinous substance. Fish oil yields an opalescent solution showing a white reflection on the sides of the tube; the opalescence increases on cooling, but only a trace of lustrous precipitate is formed. The same difference is observed by operating on the products obtained on repeated purification by alcohol.

Vegetable oils, such as linseed, hempseed, nut, and wood (? croton) oils, yield clear solutions, depositing on cooling a more or less abundant gelatinous precipitate; in the case of hempseed oil, this may take some hours and there is a danger of overlooking it. In the case of animal oils, such as seal, whale, cod-liver, shark-liver, and sperm oils, the solution of the bromine derivative in carbon tetrachloride is always opalescent, and yields but a trace of a crystalline precipitate.

*Improved Application of the Test.*—Twenty-eight c.c. of glacial acetic acid are mixed with 4 c.c. of nitrobenzene and 1 c.c. of bromine. 0.5 gram of the oil is mixed in a test-tube with 10 c.c. of the reagent, the tube is corked, gently shaken, and the effect observed.

1. Oils which do not give any precipitate sooner or later and remain clear even after an hour. *Vegetable oils*: olive oil, almond oil, castor oil, white earth-nut oil, cotton oil, and poppy oil; *Animal oils*: lard oil and neats-foot oil derived from oxen, sheep, and horses. 2. Oils which give no marked precipitate even after an hour, but give a slightly turbid solution. *Vegetable oil*: Joffa sesamé oil; *Animal oils*: some kinds of neats-foot oil derived from sheep and horses. 3. Oils which become turbid and gradually yield a precipitate, collecting more or less rapidly at the bottom of the tube. *Vegetable oils*: nut oil (precipitates after 5 or 10 minutes), hemp-seed oil, some kinds of linseed oil; *Animal oils*: Japanese fish oils, seal oil, shark oil, whale oil, and sperm oil. 4. Oil which causes a turbidity and separates on standing into two different liquid layers. Colza oil. The turbidity disappears at once on shaking with 10 c.c. of ether, but if the oil should contain 10

per cent. or more of drying oils, or fish oils an insoluble precipitate will be noticed.

Excepting colza oil, the oils may be divided into two classes; the first one containing the fish oils, and nearly the whole of the drying oils, and the other the non-drying oils and those from terrestrial animals. By the process described, mixtures containing 10 per cent., or even less, of the former may be easily recognised. To ascertain whether the precipitate is derived from a drying vegetable oil or a marine-animal oil, it is collected on a filter, washed with ether, pressed dry between "Papier Joseph," and then dissolved in boiling carbon tetrachloride, the filtrate being again boiled, and passed twice through the filter. The filtrate is evaporated to dryness in a tared dish. If the quantity should be rather small, it is dissolved in boiling carbon tetrachloride, and introduced into a previously graduated tube 15 cm. long and 4 mm. wide. The top part of the tube being heated, the liquid is boiled until for every 0.1 gram of precipitate 2.5 c.c. of solvent are left; the tube is then corked or sealed, and after three or four hours the contents are examined. If the brominated precipitate was due to a vegetable drying oil, the liquid will be either clear and thin with a gelatinous precipitate on the top, or this may occupy the whole of the volume. When due to the oil from marine animals, the liquid is white or yellowish and opalescent, with occasionally a trace of a brilliant lamellar precipitate. When due to neats-foot oil from terrestrial animals, the liquid is clear, non-opalescent, and free from gelatinous precipitate; occasionally, however, a slight turbidity is noticed.

Oils from marine animals are characterised by forming an immediate precipitate with the reagent; oils from terrestrial animals take a long time to deposit.

L. DE K.

**Estimation of the Iodine Number of Fats.** By C. A. JUNGCLAUSSEN (*Chem. Centr.*, 1901, ii, 1324; from *Apoth. Zeit.*, 16, 798).—Hanuš's method (this vol. ii, 112) is strongly recommended. When operating on about 0.13 gram of cod liver oil the iodine number was 141.5 after a quarter of an hour; 146.2 after half-an-hour; 151.6 after an hour; 152.14 after 2 hours, and 153.74 after 10 hours. The author thinks that the action is complete after 4 hours.

L. DE K.

**Japan-Tallow.** By OSCAR BERNHEIMER and F. SCHIFF (*Chem. Zeit.*, 1901, 25, 1008).—A specimen of unadulterated Japan-tallow, having the usual melting point (52.6—53.4°) and saponification number (220—222), may yet have an iodine number (10.5—11.3) higher than the normal value (4.2), and an acid number (11.4—14) lower than the normal value (20).

K. J. P. O.

**Method for the Separation of Organic Bases from their Phosphotungstic Acid Precipitates and the Behaviour of Cystine to Phosphotungstic Acid.** By ERNST WINTERSTEIN (*Zeit. physiol. Chem.*, 1901, 34, 153—156).—Instead of decomposing the phosphotungstate precipitate with barium hydroxide, the author recommends shaking it with ether and hydrochloric acid. Three layers are thus obtained, at the top aqueous ether, at the bottom a



syrupeous ethereal solution of phosphotungstic acid, and between them an aqueous solution of the hydrochlorides of the bases. The operation is repeated and the combined aqueous solutions evaporated. Good results can be obtained. According to the author, cystine is slowly precipitated by phosphotungstic acid, as is also cysteine, the latter, however, probably as cystine (compare Mörner, *Abstr.*, 1900, i, 128).  
J. J. S.

**Detection of Cocaine.** By HANS PROELSS (*Chem. Centr.*, 1901, ii, 1321; from *Apoth.-Zeit.*, 16, 779—781, 788—789. Compare *Abstr.*, 1901, ii, 706).—Cocaine cannot be detected in organs after about 14 days, as it is converted into ecgonine, which cannot be extracted by means of an immiscible solvent either from an acid or alkaline solution, and is not precipitated by the ordinary alkaloidal reagents; moreover, there is no characteristic test for ecgonine. A really trustworthy test for cocaine itself is still a *desideratum*; the best test as yet proposed is based on the reduction of mercurous chloride.  
L. DE K.

**Resistance of Morphine to Putrefaction.** By THEODOR PANZER (*Zeit. Nahr. Genussm.*, 1902, 5, 8—10).—The author succeeded in proving the presence of morphine in organs (part of large and small intestine, stomach and contents, liver, kidney) after these had been drenched with water and kept for 6 months in a loosely covered beaker.

The amyl alcohol extract obtained in due course was, as might have been expected, very much contaminated with objectionable matter. To purify the mass, it was treated with dilute hydrochloric acid and the extract shaken with amyl alcohol, which removed nearly all the colouring matter. The acid solution was now rendered alkaline with ammonia and shaken with pure ethyl acetate; this, on spontaneous evaporation, yielded an amorphous mass which completely dissolved in dilute hydrochloric acid. This solution soon deposited colourless needles which gave all the reactions for morphine; in another experiment, however, it was found necessary to decolorise the solution with animal charcoal.  
L. DE K.

**The Proteids of Urine.** By A. HERLANT (*Chem. Centr.*, 1902, i, 141—142; from *Bull. assoc. belge Chimistes*, 15, 311—313).—Mucin may be precipitated by adding to the urine 1/20 part of acetic acid and heating for an hour at 30—40°. The only safe test for albumin is the boiling test; when the sp. gr. of the sample falls below 1.015, 2—3 per cent. of sodium chloride or sulphate should be added. Trichloroacetic acid is preferable to ordinary acetic acid. Serum-albumin and globulin are precipitated as usual with magnesium sulphate.

The biuret reaction is obtained with albumin as well as with albumoses and peptones. The author first precipitates the albumin, heats the filtrate with zinc sulphate at 30—40°, and estimates the nitrogen in the zinc precipitate by Kjeldahl's process; multiplied by 6.25, this represents albumoses. If the filtrate should again give the biuret reaction, peptones are present, the exact estimation of which is very difficult.

Organised sediments may be freed from adhering urate deposits by adding to the sample 1/20 of its volume of formaldehyde.

L. DE K.

**Detection of the Colouring Matters of the Blood in Urine.** By OTTO ROSSEL (*Chem. Centr.*, 1902, i, 142; from *Schweiz. Wochschr. Pharm.*, 39, 557—558).—The sample is strongly acidified with acetic acid, agitated with an equal volume of ether, and any emulsion removed by adding a drop of alcohol. The ethereal layer is then transferred to another test glass containing a few drops of water. Fifteen to twenty drops of old oil of turpentine and five to ten drops of fresh hydrogen peroxide are added, and after gently shaking, ten to twenty drops of a freshly prepared 2 per cent. alcoholic solution of Barbadoes aloes are also added, and the whole vigorously shaken. In the presence of a trace of blood so small that it cannot be proved spectroscopically, the aqueous layer assumes, after 1—3 minutes, a reddish colour, which after 10 minutes turns to a beautiful cherry-red.

L. DE K.

**Forensic Detection of Blood by means of Alkaline Hæmatoporphyrin.** By ERNST ZIEMKE (*Chem. Centr.*, 1901, ii, 1322; from *Vierteljahrschr. ges. Med. u. öffentl. Sanitätswesen*, 22, 231—234).—The material suspected to contain blood stains is finely divided, put into a beaker, and covered with sulphuric acid. After 24 hours, the acid is filtered through glass-wool, diluted with four times its bulk of water, and neutralised with ammonia. The precipitate is washed several times by decantation, collected on a filter, air-dried, rubbed with a mixture of equal parts of alcohol and ammonia, and filtered. The filtrate forms a more or less dark red liquid, which shows the characteristic four-banded spectrum of alkaline hæmatoporphyrin; if the liquid is too concentrated, the bands in the violet are lost in the general absorption which takes place. If the liquid is too dilute, it must be concentrated, or thicker layers employed. When the filtrate is poured drop by drop into strong sulphuric acid, the resulting solution also shows the spectrum, but not so plainly as in alkaline solution.

L. DE K.

**Ehrlich's *p*-Dimethylaminobenzaldehyde Reaction.** By CLEMENS (*Chem. Centr.*, 1901, ii, 1320; *Deutsch. Arch. Klin. Med.*, 71, 168—174).—*p*-Dimethylaminobenzaldehyde gives a cherry-red coloration of varying intensity, even with previously boiled normal urine, the colouring matter is partly soluble in chloroform and completely in epichlorohydrin and dichlorohydrin. The author has tried the action of the reagent on a number of pathological urines and comes to the conclusion that the reaction is not caused by any components of either normal or pathological urine already known. The fact that urines which give the reaction do not show an increased reducing power does not tally with Pröscher's theory that the colouring matter may be a formyl-glucosamine or an acetyl derivative of an unknown pentosamine; moreover, the test is not given by glucosamine, lævulosamine, or lactosamine.

L. DE K.

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## General and Physical Chemistry.

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**Decomposition of Hydrogen Peroxide by Light, and the Electrical Discharging Action of this Decomposition.** By R. F. D'ARCY (*Phil. Mag.*, 1902, [vi], 3, 42—52).—A solution of hydrogen peroxide is decomposed much more rapidly when exposed to the sun than when kept in diffuse light. Under the influence of sunlight, a surface of hydrogen peroxide loses a negative charge of electricity more rapidly than a similar water surface. This action of light on hydrogen peroxide is regarded as a possible origin of the electrically charged particles present in the air. J. C. P.

**Radioactive Substances.** By F. HENNING (*Ann. Phys.*, 1902, [iv], 7, 562—575).—The first part of the paper is a study of the radioactivity induced in metal wires by thorium oxide (see Rutherford, *Abstr.*, 1900, ii, 352) in its dependence on the surface area of the wires, the volume of the containing tube, the fall of potential, and the thickness of the inducing layer of thorium oxide.

An attempt was also made to distinguish the conductivities of radioactive and ordinary barium chlorides, but with no very definite result. J. C. P.

**Absorption of Röntgen Rays by Aqueous Solutions.** By R. K. McCLUNG and DOUGLAS McINTOSH (*Phil. Mag.*, 1902, [vi], 3, 68—79).—By an electrical method, more accurate probably than the photographic method used by other investigators, the authors have shown that (1) the absorption of Röntgen rays by water is independent of the temperature; (2) the absorption by a salt solution increases with the concentration, the connection between the two being of a logarithmic character; (3) the absorption by anions and cations increases generally with the atomic weight (compare Blythwood and Marchant, *Abstr.*, 1900, ii, 182). It has further been found that the absorption in colloidal solutions of lead, mercury, and silver (see Bredig, *Abstr.*, 1900, ii, 213) differs very slightly, except possibly in the case of mercury, from that in pure water. J. C. P.

**A Kind of Radioactivity imparted to certain Salts by Cathode Rays.** By J. C. McLENNAN (*Phil. Mag.*, 1902, [vi], 3, 195—203).—A number of salts, namely, the sulphates and sulphides of barium, strontium, and calcium, and potassium sulphate, exhibit marked radioactivity after being exposed to the action of cathode rays; to produce the effect, the salts must be heated to at least 100°, but the radioactivity is more marked at still higher temperatures. It is shown that this radioactivity is not due to the action of ultra-violet light, and has apparently no connection with the phenomenon of thermoluminescence. The heating of the excited salts may be regarded as producing ultra-violet light or as leading to the emission of a stream of negatively charged particles. J. C. P.

**Conductivity of Liquid Dielectrics under the Influence of Radium or Röntgen Radiations.** By P. CURIE (*Compt. rend.*, 1902, 134, 420—423).—It is shown that liquid dielectrics, like gases, acquire conductivity under the influence of radium or Röntgen radiations, results of the same order of magnitude being obtained in the two cases. In the case of gases, the intensity of the current increases proportionally to the difference of potential between the electrodes when this difference is slight, but becomes almost constant when the difference is increased sufficiently. In the case of the liquids, however, the proportionality exists up to a potential difference of 450 volts. Of the liquids examined, carbon disulphide gave the greatest conductivity, which reaches  $20 \times 10^{-14}$  mhos per 1 c.c. Liquids which are ordinarily almost perfect non-conductors exhibit this effect, as, for example, liquid air, light petroleum, &c. The effect was exactly the same whether the radium was kept at the ordinary temperature or at the temperature of the liquid, from which it follows that the radiation from the radium does not vary with temperature between the limits of the ordinary temperature and that of liquid air.

L. M. J.

**Some Measurements with Gas Elements.** By VINCENT CZEPINSKI (*Zeit. anorg. Chem.*, 1902, 30, 1—17).—The high *E.M.F.* observed by Bose (Abstr., 1900, ii, 704) with the hydrogen | oxygen element has been confirmed, but the author does not agree with Bose and Wilsmore (Abstr., 1901, ii, 2) as to this being due to the formation of hydrogen peroxide or persulphuric acid; it is rather to be attributed to the depolarising action of the oxygen dissolved in the electrolyte and to diffusion of the gas.

It has been found that methane is totally indifferent in an electromotive respect when opposed to a hydrogen electrode, and measurements have been made with the element  $\text{Pt} | \text{H}_2 + \text{CH}_4 | \text{H}_2\text{SO}_4, \text{aq} | \text{H}_2 | \text{Pt}$ . The pressure of the hydrogen in the methane and hydrogen mixture varied from 0.004 to 0.11 atmosphere, and the arrangement is a true gas concentration element. The *E.M.F.* should be  $E = (0.000198T) / 2 \cdot \log(P/p)$ , where  $P$  is the pressure of the pure hydrogen (1 atmo.) and  $p$  the partial pressure in the mixture. With the most dilute mixtures, the *E.M.F.* has too high a value at first, but this rapidly falls and an equilibrium is reached, although the observed *E.M.F.* does not agree well with that calculated. At the higher concentrations (4 and 11 per cent. of hydrogen in the mixture), the *E.M.F.* is at first too low, but it slowly rises and becomes constant at a value which is in very close agreement with that calculated.

The irregularities noticed with the mixtures of low hydrogen concentration are attributed to the depolarising influences of traces of oxygen dissolved in the electrolyte.

J. McC.

**Electromotive Force of the Hydrogen Chlorine Element.** By ERICH MÜLLER (*Zeit. physikal. Chem.*, 1902, 40, 158—168. Compare Abstr., 1901, ii, 537).—The *E.M.F.* of the element was determined in an apparatus similar to that used by Wilsmore (Abstr., 1901, ii, 2); the electrolyte was hydrochloric acid solution and the gases were con-



tinuously passed over the electrodes. The following values were obtained for the *E.M.F.* with the various concentrations of acid :

Normality of acid .. . . . . .	1	1/10	1/100	1/1000
<i>E.M.F.</i> .....	1.3660	1.4849	1.5460	1.5868 volts.

Assuming that *N*-hydrochloric acid is dissociated to the extent of 78 per cent., it is calculated that the electrolytic potential is 1.3532 volts.

The observed values of the *E.M.F.* are not in agreement with those calculated, and it is shown that this is partly due to the hydrolysis of the chlorine which takes place, and this increases the concentration of the  $H^+$  and  $Cl^-$ . In *N*/10 solution of hydrochloric acid, the  $H^+$  or  $Cl^-$  concentration rises from 91 to 94.03 millimols. per litre by this hydrolysis, in *N*/100 solution from 9.6 to 33.48, and in *N*/1000 solution from 0.98 to 30.48. With the aid of these concentration differences, the calculated values of the *E.M.F.* agree better with the observed values, but the deviations remain greater than the experimental error.

The origin of the chlorine (hydrochloric acid and dichromate, hydrochloric acid and pyrolusite, or electrolytic) has no influence on the *E.M.F.*, and heating the gas in order to decompose chlorine peroxide is also without influence.

J. McC.

**Conductivity of Solutions of Mixed Electrolytes.** By HANS WOLF (*Zeit. Elektrochem.*, 1902, 8, 117—119).—The conductivity of a mixture of two electrolytes differs from the sum of the conductivities of the electrolytes singly on account of (1) the change of viscosity of the solution ; (2) decreased dissociation, due to replacement of water by the other electrolyte ; (3) chemical reaction between the electrolytes. For solutions containing a small quantity of potassium chloride or sodium bromide and variable quantities of acetic acid or alcohol, the first action is alone of importance ; with stronger solutions (0.5 normal), the second comes into play.

When chloroacetic acid is used in place of acetic acid, the matter is further complicated by the occurrence of the chemical reaction to an appreciable extent. The conductivity of zinc sulphate is diminished to a greater extent by acetic acid or alcohol than is that of potassium chloride. Tartaric acid has an effect similar to that of acetic acid, except in the case of zinc sulphate, the conductivity of which is but little affected. This is doubtless due to the formation of hydrogen ions in place of zinc ions, which increase the conductivity almost as much as it is diminished by the increased viscosity. Mixtures of the salts of fatty acids with fatty acids were also examined ; in these cases, the chemical change can be calculated and allowed for ; the remaining change of conductivity is found to be very similar to that observed in the case of sodium bromide and acetic acid.

T. E.

**Faraday's Law and its Range of Validity.** By EMIL BOSE (*Chem. Zeit.*, 1902, 26, 47—48, 66—68).—From a consideration of the accurate measurements which have been made with the copper and with the silver voltameter, the author concludes that the slight deviations from Faraday's law are only apparent. To test the accuracy of the law, a salt may not be used the cathion of which is

capable of existing in two forms, for then there enters a possible disturbing factor due to the reaction  $M \cdot \cdot + M = 2M \cdot$ . The deviations found in the electrolysis of silver salts (1/10000 of the total weight of silver) are due to secondary reactions, an important one of which is attributed to oxygen occluded by the platinum electrode. Faraday's law, so far as the weight of substance deposited by a given amount of electricity is concerned, may be regarded as an absolutely exact law of nature.

From the work of Ostwald and Nernst, it is shown that we may rightly conclude that the current which passes through an electrolyte is entirely conducted by transport of material, and there is no evidence of "metallic conduction."

The author regards Faraday's law as comparable with Dalton's law of multiple proportions so far as exactitude is concerned, and views it as an extension of Dalton's atomic laws. J. McC.

**Ionisation, Ionic Velocities, and Atomic Sizes.** By WILLIAM SUTHERLAND (*Phil. Mag.*, 1902, [vi], 3, 161—177).—This theoretical paper, which is a contribution to the solution of the difficulties of the ionic theory, deals with the following points: (1) the cause of ionisation; (2) the laws of ionisation in binary electrolytes; (3) the connection between the ionic velocities and other physical properties of the atoms. It is shown that high dielectric capacity, molecular association, and ionisation in water may all be deduced from the latent or potential valency of oxygen. According to the author, a molecule of water (represented as  $\#Ob_3(\#H)_2$ , where  $\#$  is a positive,  $b$  a negative, electron) is a radicle with electric charges, yet not an ion, because the charges are equal and opposite. Such a radicle is called a stion, and the fact that certain substances do not conform to the law  $K=n^2$  is due to their containing stions, which are doublets of very large electric moment. In dealing with the laws of ionisation, the author lays stress on the part played by the viscosity of solutions. Further, the electron of the ion must be regarded as embedded in the ion, which will have a dielectric capacity different from that of the solvent; before ionisation can be satisfactorily determined, it will be necessary to have a thorough experimental investigation of the dielectric capacity of solutions. Ostwald's dilution law for acetic acid, it is suggested, may be merely the expression of equilibrium between the molecules  $(CH_3 \cdot CO_2H)_2$  and  $CH_3 \cdot CO_2H$ . Acetic acid probably exists in water in the form of double molecules; these are partly dissociated into  $CH_3 \cdot CO_2H$  molecules, and the latter are practically all ionised at the dilutions of Ostwald's experiments. J. C. P.

**New Apparatus for Determining the Relative Velocities of Ions; with some Results for Silver Ions.** By WILLIAM T. MATHER (*Amer. Chem. J.*, 1901, 26, 473—491).—The apparatus consists of two upright tubes about 18 cm. long and 2 cm. in diameter, on the upper ends of which are sealed tubes 6 cm. long and 0.5 cm. in diameter, these narrow portions being graduated in millimetres. Near the upper ends, the wide tubes are connected by a U tube, 0.5 cm. in diameter, provided at the middle with a stop-cock, and reaching to about 2 cm. above the lower ends of the wide tubes. The

electrodes, discs of silver, are introduced into the lower ends of the wide tubes. The advantages of the apparatus are that being symmetrical the current can be passed in either direction, that as it contains a large quantity of liquid a considerable change of concentration can be obtained, that the solution can be completely separated at the close of the electrolysis into two portions of accurately determined amount, and that the possibility of diffusion is small. The apparatus must be properly levelled.

The concentration change on electrolysis of aqueous and alcoholic solutions of silver nitrate and aqueous silver acetate has been determined at various temperatures and the following results obtained for the velocity ( $a$ ) of the anion: 0.1*N* silver nitrate in water at 0°,  $a=0.5411$ ; at 47.4°,  $a=0.5286$ ; and at 29.1°,  $a=0.5317$ . 0.025*N* silver nitrate in water at 0°,  $a=0.5377$  and at 45°,  $a=0.5246$ . 0.025*N* silver acetate in water at 0°,  $a=0.3734$ ; at 28.3°,  $a=0.3818$ ; at 44.7°,  $a=0.3896$ ; and at 49.4°,  $a=0.3873$ . 0.10805*N* silver acetate in alcohol (absolute) at 20°,  $a=0.594$ . 0.1*N* silver nitrate in 49.7 per cent. alcohol at 23.7°,  $a=0.5323$ . The author also calculates the absolute velocities of the silver and nitrate ions in water at different concentrations and at various temperatures. The differences between the velocities at 0° become less as the temperature rises. The effect of decrease of concentration is the same as that of increase of temperature. The results also show that the relative velocities are largely dependent on the nature of the solvent.

J. McC.

Researches on Ionised Gases. By P. LANGEVIN (*Compt. rend.*, 1902, 134, 414—417).—Experiments have been made the results of which are in complete accord with J. J. Thomson's views regarding the cause of the conductivity of gases under the influence of cathodic, &c., radiations. The experiments are not described, and the results only briefly indicated; the most important of these appear to be a proof of the recombination of the charged ions and a measurement of the ratio of the number of recombinations to the number of collisions between ions of opposite signs. This ratio, in accord with theory, is always less than unity, to which it approaches the more nearly when the mobility of the ions is small. The author states that he has obtained a method for the determination of the mobilities of the ions for different gases, and the absolute value of the recombination coefficient  $a$ , in the expression  $dp/dt = dn/dt = -apn$ , where  $p$  and  $n$  are the concentration of positive and negative ions.

L. M. J.

Instantaneous Chemical Reactions and the Theory of Electrolytic Dissociation. By LOUIS KAHLBERG (*J. Physical Chem.*, 1902, 6, 1—14).—It has generally been supposed that instantaneous chemical reactions are dependent on the presence of ions, but the author has found cases of double decomposition accompanied by immediate precipitation in solutions which are excellent insulators. Copper, nickel, and cobalt oleates are easily soluble in benzene, giving solutions that are greenish-blue, green, and dark red respectively; these solutions conduct an electric current no better than pure benzene. Sodium, magnesium, aluminium, and zinc may be kept for weeks in

the copper oleate solution without any change taking place. Cryoscopic and ebullioscopic determinations give values for the molecular weight of copper oleate varying from 2342 to 2750, so that the salt must be polymerised. A solution of dry hydrogen chloride in benzene conducts no better than pure benzene, does not dissolve dry sodium, calcium, or barium carbonate, and does not attack iron or magnesium (zinc, however, is attacked). When such a solution is added to the oleate solutions referred to above, the metals are instantly and quantitatively precipitated as chlorides; the same result is attained if a current of dry hydrogen chloride is passed into the oleate solutions. Further, it is shown that stannic chloride, phosphorus and arsenic trichlorides, and silicon tetrachloride, which are all soluble in benzene to non-conducting solutions, precipitate cupric chloride from benzene solutions of copper oleate, the greatest care being taken, in this as in all cases, to exclude moisture. The oleates of copper, nickel, and cobalt are decomposed by hydrogen sulphide in benzene solution; stannic chloride and arsenic trichloride, treated with hydrogen sulphide in benzene solution, form sulphides only slowly. A solution of hydrogen chloride in benzene, and a solution of ammonia in benzene, both insulating as well as pure benzene, give instantly, when mixed, a white, bulky precipitate of ammonium chloride. The hydrochloride of pyridine may be precipitated in a similar manner. J. C. P.

**Condensation of the Vapours of Organic Liquids in Presence of Dust-free Air.** By FREDERICK G. DONNAN (*Phil. Mag.*, 1902, [vi], 3, 305—310).—Wilson has shown (*Abstr.*, 1898, ii, 372) that the condensation of water vapour in dust-free air is intimately connected with the presence of electrical nuclei. If now a solvent possesses ionising power because its molecules have an affinity for electrons, it is to be expected that the vapour of an ionising solvent will condense in dust-free air more readily than the vapour of a non-ionising solvent. This conclusion has been tested by Wilson's method, but the results are not very decisive. In several cases, condensation took place less readily with non-ionising solvents; on the other hand, carbon disulphide was very easily condensed, whilst acetone, a solvent of moderate ionising power, condensed only with difficulty. J. C. P.

**Apparatus for Heating by Electricity.** By ANTOINE GUNTZ (*Bull. Soc. Chim.*, 1902, [iii], 27, 153—158).—The author describes a method of fitting up apparatus for heating tubes, crucibles, &c., by means of electricity, the heat being obtained, as in other cases, by passing a current through a thin platinum wire. The improvement, however, is introduced of employing a mixture of magnesia and alumina for embedding the platinum wire in place of asbestos or fusible enamel, which possess the drawback that they alter the platinum wire when the temperature is raised to 1200—1300°. Particulars are given as to the management of such a heating arrangement and of the current which may be used with it, and the author states that he finds this apparatus more economical than gas. A. F.

**Measurement of Critical Constants.** By PHILIPPE A. GUYE and ED. MALLET (*Arch. Sci. phys. nat.*, 1902, [iv], 13, 274—296).—A



continuation of previous papers (this vol., ii, 242). The experimental results are now given, and are contained in the accompanying table, where  $T_c$  is the critical temperature,  $P_c$  the critical pressure,  $\mu$  the index of refraction for the  $D$  line at the temperature indicated, and  $D$  the sp. gr. at the temperature indicated, and  $\eta$  the coefficient of viscosity :

	$T_c$ .	$P_c$ .	$\mu$ .	$D$ .	$\eta$ .
Durene .....	402.5°	28.6			
Hexamethylbenzene..	> 478	—			
Diphenylmethane ...	497	28.2			
Diphenyl .....	495.6	31.8			
Naphthalene .....	468.2	39.25			
Anisole .....	368.5	41.2	1.5173 (20.6°)	0.9918 (20.6°)	0.01039 (22.3°)
Phenetole .....	374	33.8	1.5076 (21°)	0.9657 (21°)	0.01172 (23.4°)
<i>m</i> -Cresol .....	432	45	1.5418 (13.6°)	1.0384 (14.3°)	0.16767 (21.1°)
Aniline .....	425.6	52.3	1.5848 (22°)	1.0184 (22°)	0.0405 (22°)
Dimethylaniline .....	414.7	35.5	1.5565 (23°)	0.9537 (23°)	0.0137 (21.5°)
Dimethyl- <i>o</i> -toluidine	394.8	30.8	1.5248 (23°)	0.9255 (23°)	0.01489 (22.6°)
Piperidine .....	—	45.9	1.4530 (20.7°)	0.8602 (20.7°)	0.01554 (19.6°)
Acetonitrile . . . . .	270.1	47.7	1.3417 (23.6°)	0.7785 (23.6°)	0.003466 (23.1°)
Propionitrile .....	285.7	41.3	1.3640 (24.6°)	0.7765 (24.6°)	0.004267 (21°)
Butyronitrile .....	309.1	37.4	1.3816 (24°)	0.7872 (24°)	0.005717 (22.3°)
Capronitrile .....	348.8	32.1	1.4048 (22.2°)	0.7990 (22.2°)	0.00942 (22°)
Benzonitrile .....	426.2	41.6	1.5272 (23°)	1.0016 (23°)	0.01316 (20.9°)
Propionic acid .....	326.8	—	1.3865 (21.4°)	0.9926 (21.4°)	0.01081 (23.2°)
Ethylchloroformate ..	< 235	—	1.3949 (21.2°)	1.1334 (21.2°)	0.00545 (21.1°)

An attempt was made to determine the critical temperature of water, but at 345° the tube burst, and the fragments showed that, although the experiment had lasted but a short time, the water had attacked the glass very considerably. In a number of cases, the values given for the sp. gr., refraction, and viscosity have been taken from the results of other observers ; they are, however, added for completeness, and were in many cases obtained with the specimens employed by the authors.

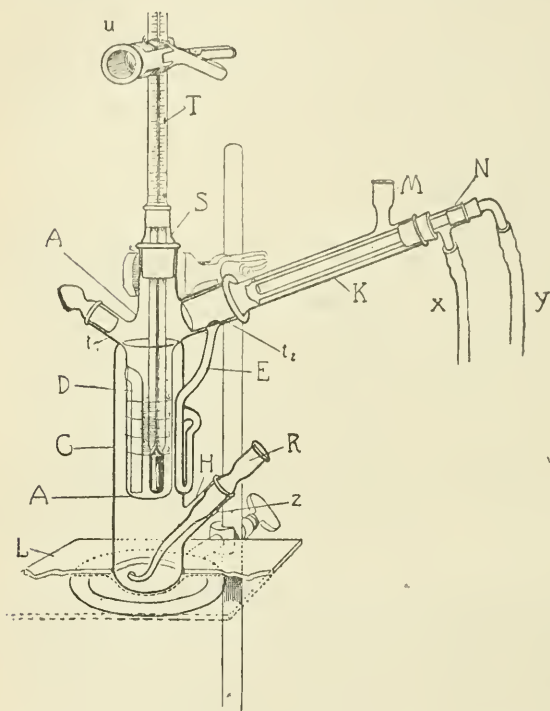
L. M. J.

**Determination of Molecular Weights. V. Further Development of the Boiling Point Method.** By ERNST BECKMANN (*Zeit. physikal. Chem.*, 1902, 40, 129—157. Compare Abstr., 1890, 323 ; 1891, 389, 1317 ; 1895, ii, 154 ; and 1897, ii, 88).—Details are given of the precautions which must be taken in using the author's boiling point apparatus in order to avoid errors on account of superheating. The amount of platinum or silver tetrahedra to be introduced in order to ensure even boiling is about 10 to 15 grams ; in place of this, 1 to 2 grams of metal and 10 to 15 of garnet crystals (such as are used for taring purposes) may be employed.

The Landsberger method is compared with the author's, and it is pointed out that the advantages lie on the side of the latter in so far as time of observation is concerned. In Landsberger's method, too, a great deal more solvent is required.

A modified form of apparatus is described where the solution is

heated by a current of vapour of the solvent. The ordinary Beckmann boiling tube, *A*, is provided with an internal tube, *D* (7 mm. diameter), fused into the side and passing to the bottom. The boiling tube is sealed into the wider vessel, *C*, at a point above the opening of the inner tube. The



outer vessel is provided with a tubulus, *R*, for supplying it with solvent, and through the tubulus a safety tube is inserted. Vapour evolved from the solvent in the outer vessel passes through the narrow tube into the boiling tube containing the thermometer, *T*. The condensed vapour may be allowed to flow back either to the boiling tube or, through a tube, *E*, which is sealed on, to the outer vessel. No solid material need be added to produce even ebullition.

The volume of the solution can be ascertained in the same way as has been described by Walker and Lumsden (*Trans.*, 1898, 502). Results are given to prove the efficiency of the apparatus.

J. McC.

**Specific Volumes of Oxygen and Nitrogen Vapour at the Boiling Point of Oxygen.** By JAMES DEWAR (*Proc. Roy. Soc.*, 1902, 69, 360—366).—By determining the vapour densities of oxygen and nitrogen at the boiling point of the former, the author has further tested the validity of the method previously employed in finding the boiling point of hydrogen and oxygen (*Abstr.*, 1901, ii, 308). The specific volume of oxygen at 90.5° absolute and 760 mm. pressure is found to be 226 c.c.; from Regnault's density of oxygen at 0° and 760 mm. pressure, the value calculated according to the gaseous laws would be 231.8 c.c.; it thus appears that the product  $pv$  is diminished at the boiling point of oxygen by 2.46 per cent. It is noted that the value thus directly found for the specific volume of oxygen is quite different from the value 358 arrived at indirectly by Behn (*Abstr.*,

1900, ii, 260). The weight of a litre of oxygen at  $90.5^{\circ}$  absolute and 282.5 mm. pressure is 1.5982 grams, a smaller value than that calculated from the change of pressure. Nitrogen at its boiling point ( $78^{\circ}$  absolute) appears to deviate from the gaseous laws about as much as oxygen; from measurements of its vapour density at the boiling points of oxygen and air, the specific volume of nitrogen at  $78^{\circ}$  is calculated to be 221.3 c.c.

J. C. P.

**Possible Significance of Changing Atomic Volume.** By THEODORE W. RICHARDS (*Zeit. physikal. Chem.*, 1902, 40, 169—184. *Proc. Amer. Acad.*, 1901, 37, 3—17).—Great compression of a substance may be due to two causes, one applied from outside, the other due to mutual internal attraction or affinity of the smallest particles for each other. The small compressibility of liquids and solids may be taken as evidence of a great compression of this second kind, and a study of the volume-changes in these cases might lead to some knowledge of the affinities at work. From the change of volume on mixing liquids, it may be gathered that similar liquids exhibit less change than dissimilar ones do; when the affinity of a substance for itself is not unlike that of the substance for another, no great change of volume occurs on mixing.

From the molecular volumes of several oxides, it is shown that the atomic volume of oxygen is not constant but is dependent on its environment; it is a function of the temperature and pressure and probably also of the electric stress. The stress under which a single substance rests may be measured by the work which heat is able to do on it, and this stress is given by  $P = Cdt/dv$ , where  $C$  is the molecular heat capacity,  $v$  is the volume, and  $t$  the temperature. The value of this stress is calculated for a number of metals, and it is concluded that there is a connection between the compression of substances and their tendency to combine with one another. From the tables of molecular volumes of chlorides and hydroxides, it is seen that when substances are arranged in the order of the contraction which ensues when hydroxyl combines with the metal, the same series is obtained as in the electrochemical order. This leads to the conclusion that the solution tension of a metal is associated with the excess of affinity of the metal for hydroxyl over its affinity for itself. This point is discussed in connection with formation of ions in aqueous solution. In aqueous solution, it is highly probable that the water as well as the salt must contract.

Chemical affinity is possibly a reciprocal function of mass, and in order to agree with the author's views, the atomic hypothesis must be modified so that the compressible environments ("atomic shell") around the centres of gravity and affinity are not so entirely disregarded as usual.

J. McC.

**Dissociation of the Hydrate and Alcoholate of Chloral in Solution.** By LUDWIK BRUNER (*Bull. Acad. Sci. Cracow*, 1901, 464—473).—In order to determine whether dissociation occurs during the dissolution of chloral hydrate and alcoholate in various solvents, the molecular increase of the boiling point was determined in solutions

in ethyl ether, acetone, methyl iodide, ethyl bromide, and carbon disulphide. A normal rise of boiling point was in all cases obtained, but with the last three solvents anomalous results were obtained; with chloral hydrate, the boiling point at first falling and afterwards slowly rising to a final value. This the author explains by the assumption of a partial dissociation, when, owing to the very slight solubility of the water produced, a two phase system results (although not apparent owing to the small quantity of water); this causes a lowering of the boiling point. The aqueous phase, however, soon distils off and the final higher value results. Cryoscopic experiments in nitrobenzene and in *p*-toluidine also lead to normal molecular weights, these solvents never differing from acetic acid in this respect (Beckmann, Abstr. 1891, 389). As chloral hydrate is partially dissociated when vaporised, the author calculated the latent heat of vaporisation from the molecular depression in chloral hydrate solutions and obtained the value 128.8 cal., which agrees well with the direct determination 132.4 cal., so that the van't Hoff expression  $\text{Mol. } D. > 0.02 \text{ } T/L$  appears to hold even for compounds which partially dissociate when vaporised.

L. M. J.

**Solubility and Dissociation of Double Salts in Water.** By EBERHARD RIMBACH (*Ber.*, 1902, 35, 1298—1309. Compare Abstr. 1898, ii, 158).—The transformation point of a double salt has already been shown to be the temperature at which the two solutions saturated respectively with the double salt and one of its components become identical.

The double salt,  $4\text{NH}_4\text{Cl}, \text{CdCl}_2$ , decomposes into  $\text{NH}_4\text{Cl}, \text{CdCl}_2$  and  $\text{NH}_4\text{Cl}$ , and an examination of the solubility curves of the systems, double salt +  $\text{NH}_4\text{Cl}, \text{CdCl}_2$ , and double salt + ammonium chloride showed that these curves converge at a temperature approximately equal to  $-20^\circ$ ; this result is obtained, however, only by extrapolation.

Rubidium chloride combines with cadmium chloride to yield the double salt  $\text{RbCl}, \text{CdCl}_2$ , which separates in anhydrous, rhombic crystals. In this respect, rubidium and ammonium are analogous and they both differ from potassium, which gives rise to the salt  $\text{KCl}, \text{CdCl}_2, \text{H}_2\text{O}$ . The solubilities of the double rubidium salt are tabulated and agree closely with the values calculated from the equation  $P(104^\circ/0^\circ) = 12.17 + 0.3279t$ , the corresponding expression for rubidium chloride itself being  $P(115^\circ/0^\circ) = 44.37 + 0.1377t$ .

The double salt,  $4\text{RbCl}, \text{CdCl}_2$ , obtained from a solution of its components containing excess of the alkali chloride, separates in rhombohedral crystals the crystallographic examination of which indicates that the compound is isomorphous with the corresponding potassium derivative,  $4\text{KCl}, \text{CdCl}_2$ . It was not found possible to produce the double salts  $6(\text{CdCl}_2, \text{RbCl}), 3\text{H}_2\text{O}$  and  $4(\text{CdCl}_2, \text{RbCl}), \text{H}_2\text{O}$ , formerly described by Godeffroy (*Ber.*, 1875, 8, 9).

The solubility of the system  $4\text{RbCl}, \text{CdCl}_2 + \text{RbCl}, \text{CdCl}_2$  was studied, the results being tabulated and also expressed in the form of a curve. The transformation point of the double salt was not determined, however, owing to the fact that the system  $4\text{RbCl}, \text{CdCl}_2 + \text{RbCl}$  could not be obtained in solution, the double salt being practically insoluble



in rubidium chloride solution. This singular property of the double chloride is paralleled by the slight solubility of rubidium alum and rubidium magnesium chloride in solutions of aluminium salts and magnesium chloride respectively.

G. T. M.

**Determination of the Molecular Weights of Substances in the Liquid State.** By WLADIMIR A. KISTIAKOWSKY (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 70—90).—The author arrives at the following simplified formula for calculating the molecular weight of a liquid from the coefficient of capillarity:  $M = (2 \cdot 3 T / g \cdot h \cdot r \cdot \rho^{1/3})^{3/2}$ , where  $T$  is the absolute boiling point of the liquid;  $g$  the acceleration due to gravity;  $h$  the height of the liquid in the capillary;  $r$  the radius of the capillary; and  $\rho$  the density of the liquid. A simplified form of apparatus is sketched and described, and the results of a number of measurements tabulated.

T. H. P.

**Chemical Dynamics of Nickel Carbonyl.** By ALWIN MITTASCH (*Zeit. physikal. Chem.*, 1902, 40, 1—83).—The vapour pressure curve of the compound was determined, and also the pressure-temperature curve of the unsaturated vapour. The latter curve is normal, the vapour obeying the gas laws, but evidences of decomposition were obtained at temperatures above 50°. The decomposition and progress of the reversible reaction,  $\text{Ni}(\text{CO})_4 \rightleftharpoons \text{Ni} + 4\text{CO}$ , could hence be followed by a manometric method, which was that adopted by the author. A full description of the apparatus and method is given, as well as of the various difficulties which occurred, and the precautions necessary to meet them. The reaction was proved to be reversible, the same end state of the system being obtained when it is attained from higher as when it is attained from lower temperatures, that is, when the reaction is proceeding as a formation or as a decomposition process. The equilibrium constant is given by  $c_1^4/c_2$  where  $c_1$  and  $c_2$  are the concentrations of carbon monoxide and of nickel carbonyl respectively, and satisfactory agreement was obtained for this constant in each set of experiments, but, as would be expected, it varies with the nature of the nickel employed. Increase of pressure should considerably decrease the decomposition, and this was experimentally verified. For mean concentrations, the whole range of the decomposition curve lies within a comparatively small range of temperature, being negligible at 0° and practically complete at 120°; a number of equilibrium curves, composition against temperature, are given for varying concentrations. The effect of various kinds of nickel was examined; it was found that the finest powder had the greatest active mass, and hence gave the smallest value for the decomposition. Traces of air were found to have a very marked inhibiting effect on the reaction, this being, however, counteracted by small quantities of hydrogen sulphide, whilst small quantities of mercury have an accelerative action. From the variation of the reaction constant with temperature, values for the heat of formation are obtained varying from 23 to 32 cals., whereas that determined experimentally by the author was 43·36 cals.; in the calculation, however, the effect of temperature on the active mass of the nickel itself is neglected. The velocities of formation and decomposition were also investigated. It was found, as is indicated theoretically,

that the temperature coefficient of the decomposition velocity is greater than that of the formation velocity. The decomposition proceeds as a unimolecular reaction, but, contrary to expectation, the formation was found to be bimolecular and not quadrimolecular. This indicates that the formation proceeds in two stages, with probably the formation of an intermediate compound,  $\text{Ni}(\text{CO})_2$ . L. M. J.

**Heterogeneous Equilibrium between mixed Isomorphous Crystals of Hydrated Salts.** By GIUSEPPE BRUNI and WILHELM MEYERHOFFER (*Atti R. Accad. Lincei*, 1902, 11, i, 185—190. Compare Abstr., 1901, ii, 11).—The authors consider the equilibrium existing between two isomorphous salts which dissolve in water giving one or more hydrates, of which those of corresponding composition form isomorphous pairs. A solution of two such salts can only have four phases, namely, two kinds of mixed crystals, solution, and vapour. The temperature of transformation curve will hence be continuous and may, of course, have one of three forms. By the application of the method used by Roozeboom (Abstr., 1900, ii, 132) for the study of the phenomena of congelation and transformation of binary mixtures, and also of Gibbs's theorem according to which at any temperature that system is stable for which the function  $\zeta$  has the smaller value, the authors arrive at the conclusion that that component which, added to the system, produces a rise in the temperature of transformation is contained by the more highly hydrated mixed crystals in greater proportion than by those poorer in water.

The treatment of more complex cases, in which, for example, one or both the hydrates can be formed only within certain limits of temperature, involves analogous considerations, but the transformation curves will then show multiple points. T. H. P.

**Equilibrium in the System: Sodium Carbonate, Ethyl Alcohol, and Water.** By C. H. KETNER (*Zeit. physikal. Chem.*, 1902, 39, 641—690).—The equilibrium in the binary system sodium carbonate and water was first investigated and the absence of hydrates other than those of the composition  $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$ ,  $\text{Na}_2\text{CO}_3 \cdot 7\text{H}_2\text{O}$ , and  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$  was verified (Andreae, Abstr., 1891, 781). Of the two heptahydrates, one is stable and known as  $7\beta$ , the other,  $7\alpha$ , is throughout in the labile state. The following equilibrium points were determined:  $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O} - \text{Na}_2\text{CO}_3 \cdot 7\text{H}_2\text{O}$ —solution at  $35.1^\circ$ , and  $\text{Na}_2\text{CO}_3 \cdot 7\text{H}_2\text{O} - \text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ —solution at  $31.85^\circ$ , the heptahydrate being only stable therefore over a range of about three degrees. The equilibrium in the ternary system was then investigated: representing the solid phases by  $Z_{10}$ ,  $Z_7$ , and  $Z_1$ , the aqueous and alcoholic liquid phases by  $L_w$  and  $L_a$ , and the vapour phase by  $D$ , the following results were obtained. At temperatures above  $34.6^\circ$ , two liquid phases may be in equilibrium with the monohydrate, that is, the system  $Z_1 + L_w + L_a + D$  exists and the composition of the liquid phases are represented by curves. At  $34.6$  a quintuple point is obtained, the heptahydrate being now also formed, the system hence being  $Z_7 + Z_1 + L_w + L_a + D$ , the reaction with temperature change being  $Z_7 + L_a \rightleftharpoons Z_1 + L_w$ . Between  $34.6^\circ$  and  $31.1^\circ$ , the liquids can only be in equilibrium with the heptahydrate, but at  $31.1^\circ$  the decahydrate is first obtained

and a second quintuple point results,  $Z_{10} + Z_7 + L_w + L_a + D$ . The analyses for the determination of the various quadruple curves meeting at the quintuple points are recorded and the variation of solubility by addition of alcohol is seen. Diagrams of the isothermals are given. At  $21.8^\circ$ , the isothermal consists of four parts representing the solutions in equilibrium with the three stable hydrates and the anhydrous salt, the points of intersection of the curves giving the equilibrium points for  $Z_{10}Z_7$ ,  $Z_7Z_1$ , and  $Z_1Z$ . At  $27.7^\circ$ , the solubility curve of  $Z_{10}$  is tangential to the binodal curve, so that above this temperature two liquid layers in equilibrium with  $Z_{10}$  may occur and the isothermals for  $28.2^\circ$  and  $29.7^\circ$  are given. When the temperature reaches  $31.1^\circ$ , the equilibrium point for  $Z_{10}Z_7$  falls on the binodal curve, so that above this temperature  $Z_7$  may be in equilibrium with two conjugate solutions. Similarly, above  $35.1^\circ$  the monohydrate occurs in equilibrium with  $L_w$  and  $L_a$ . A representation of the complete equilibrium surface is also added. The vapour pressure curve was also investigated for the quadruple curve,  $Z_1 + L_w + L_a + D$ . It was found that for certain alcoholic concentrations, namely, all above 2.2 per cent., the addition of sodium carbonate lowers the boiling point and hence increases the vapour pressure.

L. M. J.

**Physical Peculiarities of Solutions of Gases in Liquids.** By J. ALFRED WANKLYN (*Phil. Mag.*, 1902, [vi], 3, 346—348).—When carbon dioxide is separated from strong potash by a layer of water saturated with the gas, no absorption is apparent for many hours. The author regards this as proof that there is no motion of the  $\text{CO}_2$  molecules among the  $\text{H}_2\text{O}$  molecules; probably one  $\text{CO}_2$  molecule forms with many  $\text{H}_2\text{O}$  molecules one big compound molecule.

J. C. P.

**Solubility of Ammonia in Salt Solutions, as Measured by its Partial Pressure. I.** By RICHARD ABEGG and H. RIESENFELD (*Zeit. physikal. Chem.*, 1902, 40, 84—108).—The partial pressure of a solution was found by allowing electrolytic gas to pass through the solution and then through an absorption cell containing a solution of hydrogen chloride; from the variation in conductivity of the latter, the quantity of ammonia and hence the partial pressure was determined. It was found that the partial pressure was proportional to the concentration for solutions examined, which were about 0.5 *N* and 1.0 *N*. The salts examined were those of the alkali metals, and in almost all cases the addition of salt causes an increase of the partial pressure of ammonia, this increase being proportional to the concentration of the salt; lithium salts are, however, exceptional. No noteworthy results are obtained if the concentrations are expressed per 100 grams of water instead of per litre. The salts may be divided into two groups, those giving a molecular increase of pressure less than 2.3 and those giving the molecular increase greater than 3.4. Those giving the lower value are those containing univalent anions. The following, however, gave the higher value: hydroxides, fluorides, borates, acetates, formates, chlorates, and iodates, the action being apparently additive. The higher value appears to be connected with the tendency to form hydrates, whilst hydrates do not exist in the case



of the salts for which the lower value is obtained. From the change of partial pressure, the solubility lowering can be calculated, and this is found to be in general agreement with the lowering of solubility of other substances. By the comparison of the lowering of solubility at different temperatures, indications of chemical action may be obtained, and evidences of such action appear to exist in some cases, notably the alkali chlorides (compare Gahl, Abstr., 1900, ii, 389). L. M. J.

**Nitriles as Solvents in Molecular Weight Determinations.** By LOUIS KAHLENBERG (*J. Physical Chem.*, 1902, 6, 45—49).—Using the values recently obtained for the latent heat of evaporation of benzonitrile (Luginin, Abstr., 1900, ii, 334; Kahlenberg, this vol., ii, 195), the author finds the molecular elevation of the boiling point for this solvent to be 48.67—a value considerably greater than that used by Werner (Abstr., 1898, ii, 214). The author has recalculated Werner's results for the solutes diphenylamine, mercuric chloride and iodide, and silver nitrate, and adds a series of his own determinations with the last named. The molecular weight found is high in every case (40 to 50 per cent. higher than the theoretical value), a result probably connected with the high boiling point of the solvent. The solutions of mercuric chloride and iodide and silver nitrate are fairly good electrolytes; that of diphenylamine is a non-electrolyte.

The molecular elevation of the boiling point of acetonitrile is found to be 14.39. In this solvent, naphthalene and diphenyl give values that are slightly higher, diphenylamine and silver nitrate values that are lower, than the normal molecular weight. The solutions of naphthalene, diphenyl, and diphenylamine are non-electrolytes; that of silver nitrate is a very good electrolyte. J. C. P.

**Inorganic Ferments.** By DOUGLAS MCINTOSH (*J. Physical Chem.*, 1902, 6, 15—44. Compare Bredig and Müller von Berneck, Abstr., 1900, ii, 213; Bredig and Ikeda, Abstr., 1901, ii, 441; Bredig and Reinders, Abstr., 1901, ii, 442).—The paper deals chiefly with the catalytic effect of colloidal silver on the decomposition of hydrogen peroxide, and the results are summarised as follows. In acid or neutral solution, colloidal silver decomposes hydrogen peroxide until it is dissolved; the rapid decomposition induced by colloidal silver in alkaline solution follows the course of a unimolecular reaction. Silver salts in alkaline solution are completely reduced to silver, which then exerts the same catalytic influence as colloidal silver. Substances which form compounds with silver not decomposed by hydrogen peroxide exert a retarding influence on the catalysis. Colloidal mercury, or mercury reduced from its salts, acts in alkaline solution like colloidal silver. J. C. P.

**Solutions of Inorganic Salts in Water.** By WILHELM BILTZ [with JULIUS MEYER] (*Zeit physikal. Chem.*, 1902, 40, 185—221).—It is recognised that a number of electrolytes do not give values for the degree of dissociation in agreement with Ostwald's dilution law; but the number is not great and the authors believe that more details must be obtained before the reason for the deviations can be arrived



at. In order to contribute to this subject, the authors have determined the cryoscopic values of several salts in aqueous solution over a wider range of concentration than has yet been done.

The vapour pressure of solutions of the chlorides of calcium, strontium, and barium was determined at  $25^{\circ}$  by the method described by Walker (Abstr., 1889, 6). The molecular weights calculated from the results show no progressive change, indicating that there is no retrogression of the dissociation with increasing concentration up to 100 grams per litre of water.

The cryoscopic behaviour of solutions of the following salts was determined in a specially constructed apparatus: chlorides of caesium, rubidium, potassium, ammonium, sodium, lithium, mercury, copper, zinc, manganese, nickel, cobalt, and iron ( $\text{FeCl}_2$ ); bromides of aluminium and copper; potassium thiocyanate, cyanide, bromide, iodide, and fluoride; and lithium nitrate, bromide, and iodide. The solutions examined varied from  $0.04N$  to  $0.6N$ , and the results are given graphically, using the normalities as abscissæ, and the corresponding molecular depressions of the freezing point,  $k$ , as ordinates. The curves obtained for the chlorides of the alkali metals show that when the metals are arranged according to the magnitude of the deviation from the law of mass action we obtain the series: Cs, Rb, K,  $\text{NH}_4$ , Na, Li. In the same way, the following series is obtained from the chlorides of bivalent metals: Ba, Sr, Cu, Zn, Mn, Ca, Ni, Co, Mg, Fe. In all these cases,  $k$  exhibits a minimum value. The values obtained for mercuric chloride confirm the observation that this is very little dissociated. For aluminium bromide, the values of  $k$  varied from 14 to 10.7, when the concentration changed from  $0.078N$  to  $4.355N$ , and this leads to the conclusion that in aqueous solution aluminium bromide exists in double molecules at high concentrations. From the results with the potassium and lithium salts, it is seen that the order in which the anions affect the deviation is: SCN, CN, Cl, Br, F, I the last having the greatest effect.

Ebullioscopic determinations have been made with the chlorides of some of the alkali metals, and the results are in fair agreement with the cryoscopic values for the molecular weight.

The results obtained show that when the salts are arranged according to the  $k$  values the same series is arrived at as when they are ordered according to their molecular heats of solution.

The degrees of dissociation of rubidium and caesium nitrates have been calculated, and it is found that the change is not regular. The same is true of the degrees of dissociation of these two salts as found from the conductivity of the solutions.

The series given above for the cations and anions is the same as their decomposition tensions and the author connects this with Abegg and Bodländer's theory (Abstr., 1899, ii, 542), and assumes that complex formation takes place, water being the neutral component. The deviations can be accounted for by assuming that hydrates are formed in solution. Tentatively, it is calculated that in  $0.1$  to  $0.5 N$  solution potassium and sodium chlorides near  $0^{\circ}$  chemically bind about 40 mols. of water per mol. of salt. The complexes are broken down as the temperature rises, and therefore we should expect results from

ebullioscopic determinations would give values in closer agreement with the law of mass action than those obtained at  $0^{\circ}$ ; as Kahlenberg (*J. Physical Chem.*, 1901, 5, 375) has recently shown, this is probably the case. Formation of hydrates is also shown to be supported by the heats of solution.

J. McC.

**Properties of Nitrogen Peroxide as a Solvent.** By GIUSEPPE BRUNI (*Gazzetta*, 1902, 34, i, 187—188).—A claim for priority (see Abstr., 1900, ii, 591; *Proc.*, 1902, 47).

T. H. P.

**Gelatinisation.** By S. A. LEVITES (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 110—118).—The author has examined the gelatinisation of gluten,  $\delta$ -galactan and starch under various conditions, more especially in the presence of certain salts, which exert a retarding influence on the gelatinisation. The temperature at which starch forms a paste is lowered by the presence of salts; the following table gives the temperatures of gelatinisation for maize starch which ordinarily forms a paste at  $66$ — $68^{\circ}$ :

In 10 per cent.	ammonium or potassium thiocyanate ...	46—48°
„ 20 „	potassium or sodium iodide .....	46—48
„ 20 „	„ „ bromide... ..	52—54
„ 20 „	ammonium nitrate .....	52—54

In a solution containing 15—20 per cent. of ammonium or potassium thiocyanate, or 40 per cent. of potassium or sodium iodide or 50—60 per cent. of the bromide, maize starch gelatinises at the ordinary temperature. Zulkowski's starch solution, which contains 10—20 parts of starch per 100 of water and solidifies to a stiff jelly, is entirely prevented from gelatinising by the presence of 10 per cent. or even less of potassium or sodium iodide or thiocyanate. Other substances such, for instance, as di- and tri-hydric phenols, exert an influence on the gelatinisation of these substances similar to those of salts.

From the results of his measurements, the author supposes that such retardation of the process of gelatinisation is due to the more ready solubility of the gelatinising substances in the salt solutions; and the greater this solubility the more slowly will the gelatinisation take place. Analogies are indicated between the separation of crystalline compounds from solution and the gelatinisation of colloids.

T. H. P.

**Position of the Rare-Earth Elements in Mendeléeff's Periodic System.** By BOHUSLAV BRAUNER (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 142—153).—After considering the properties of, and the compounds formed by, the metals of the rare-earths, the author proposes an alteration in Mendeléeff's table by which the elements Ce, Pr, Nd, Sa, En, Gd, Tb, Ho, Er, Tu, Yb are placed in an inter-periodic group.

T. H. P.

**New Flasks for Washing and Drying Gases.** By WETSCHIAS-LAW E. TISTSCHENKO (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 67—79).—The

author describes, with sketches, a new form of washing apparatus for gases. It consists of a cylindrical glass vessel standing on a foot and divided into two halves by a vertical partition passing down the middle. If the washing material is solid, this partition terminates some distance from the bottom, whilst if the apparatus is to contain liquid, the partition passes the whole way down except for a small distance in the middle, where a small opening is left for the gas to bubble through from one side to the other. Two tubes, one in each half of the vessel, serve as inlet and outlet tubes and an aperture, closed by a stopper, in the top allows of the charging and cleaning out of the apparatus. The stream of gas passes from the top to the bottom of one side of the vessel, then under the partition, up the other side, and out by means of the exit tube. The device is simple, effective, and not readily broken.

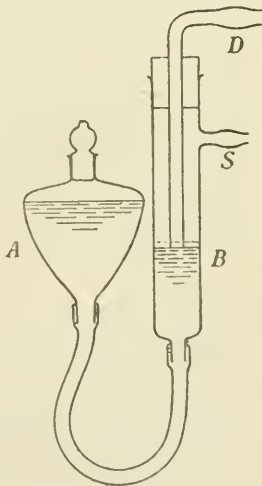
T. H. P.

**Pressure Regulator for Vacuum Distillation in the Laboratory.** By WALTER BURSTYN (*Chem. Centr.*, 1902, i, 614—615; from *Oesterr. Chem. Zeit.*, 5, 55—56).—By means of the apparatus or “manostat,” shown in the figure, the pressure in the distilling flask during distillation under diminished pressure may be automatically kept within certain limits.

The glass vessels *A* and *B* are connected by pressure tubing and filled with mercury to the levels shown in the figure. The air-pump and distilling apparatus are connected with *S* and *D* respectively. Before the pump is set going, the vessel *A* is completely filled with mercury by lowering it and then carefully inserting the stopper. The air is then pumped out, and as soon as the pressure is reduced to the required amount (for example, 20 mm.), *A* is raised until the mercury in *B* just touches the lower end of the tube *D*, a Torricellian vacuum being formed in *A*. If the pressure then sinks below the required amount (for example, to 15 mm.), the difference is at once equalised by the rising of the mercury in *B* (5 mm. to the dotted line). When the pressure is increased by the entry of air or liberation of gas, the excess is removed by the pump. With this arrangement it is not necessary to use a pressure flask, but the volume of connecting tubes, &c., between the manostat and the pump should be reduced to a minimum.

In cases where a mercury pump is used and a vacuum of 5 mm. or less is required, it is better to fill the manostat with paraffin oil, which is only one-fifteenth as heavy as mercury; the vapour tension of the paraffin oil need not be considered.

E. W. W.



## Inorganic Chemistry.

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**Decomposition of Hydrogen Peroxide by Various Substances at High Temperatures.** By J. H. KASTLE and MARY E. CLARKE (*Amer. Chem. J.*, 1901, 26, 518—526).—The amount of oxygen liberated from hydrogen peroxide solution at 100° in presence of various salts was determined. Iron salts, potassium iodide, and chrome alum decompose the hydrogen peroxide with great rapidity; with nickel and cobalt salts, the decomposition is much slower, but ultimately it is very nearly as great. Other salts cause a much more gradual decomposition. In the case of certain salts, notably copper sulphate and potassium dichromate, the decomposition seems to be a true catalysis. The most active substances appear to be those which are acted on chemically by the hydrogen peroxide or those containing an element capable of combining with oxygen in several different proportions. The investigation is being continued. J. McC.

**Behaviour of Hydrogen Peroxide with certain Salts.** By PETR G. MELIKOFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 207—210).—The compounds obtained by the action of hydrogen peroxide on various salts are of three kinds: (1) compounds of per-acids with hydrates of metallic oxides; (2) compounds of normal acids with metallic peroxides; (3) compounds of per-acids with metallic peroxides. From a consideration of the work described by Kazanezky and by Petrenko, and of his own work with Pissarjewsky (this vol., ii, 316, 317, 326), the author draws the following conclusions. The elements of the fourth group having high atomic weights yield per-acids with hydrogen peroxide; this is also the case with the element boron of low atomic weight, the oxide of which has both basic and acid properties. Elements with acid properties only yield per-acids by means of the electrolysis of their salts. T. H. P.

**Relative Strength of Hydrochloric and Nitric Acids.** By G. BODLÄNDER and OTTO SACKUR (*Ber.*, 1902, 35, 1255).—A reply to Kühling (this vol., ii, 252). W. A. D.

**Pure Iodine.** By ALBERT LADENBURG (*Ber.*, 1902, 35, 1256—1257).—"Pure" potassium iodide was converted into silver iodide and the latter freed from silver chloride by shaking for 24 hours with concentrated ammonia; the ratio of the solubility in ammonia of silver iodide to that of silver chloride is approximately 1:1000, and the silver iodide as treated above, was considered pure when its solubility in 100 parts of ammonia of sp. gr. 0.971 reached a constant value of 0.0045. Pure iodine was obtained by reducing the silver iodide with zinc and sulphuric acid, precipitating the solution with nitrous acid, distilling with steam, and drying over calcium chloride; it was blacker and less volatile than ordinary iodine, boiled at 183.05° (corr.), melted in a Roth's apparatus at 116.1° and had a sp. gr. 4.933 at 4°/4°. W. A. D.



**Double Salts of Iodine Trichloride with Chlorides of Divalent Metals.** By RUDOLPH F. WEINLAND and FR. SCHLEGELMILCH (*Zeit. anorg. Chem.*, 1902, 30, 134—143).—The double salts were prepared by adding excess of iodine to a saturated solution of the metallic chloride and passing a current of chlorine through the solution; on cooling, the double salt separates out and is dried on porous porcelain. They all crystallise well, but are very unstable and hygroscopic; carbon tetrachloride extracts iodine trichloride from them. They all have the formula  $2\text{ICl}_3 \cdot \text{MCl}_2 \cdot 8\text{H}_2\text{O}$ . The following have been obtained: *cobalt* salt, dark orange-red needles; *nickel* salt, fine green crystals; *manganese* salt, orange-red needles; *zinc* salt, golden plates; *beryllium* salt, yellow needles; *magnesium* salt, yellow needles; *calcium* salt, golden needles, and *strontium* salt, golden needles. It has not been possible to obtain double salts with the chlorides of barium, cadmium, copper, mercury, or lead. J. McC.

**The Existence of a Blue or Green Modification of Sulphur.** By N. A. ORLOFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 52—67. Compare Abstr., 1901, ii, 499).—From a consideration of the work previously published on this subject and of his own experiments, the author concludes that there exists a peculiar modification of sulphur, which has a blue or (when mixed with the yellow form?) green colour and is very unstable, being only able to exist (1) at the moment of its formation in certain reactions and in a peculiar state of fixation on some chlorides, and (2) more stably combined with certain inorganic, and possibly also organic, compounds. Among the conditions of formation of this modification of sulphur, the most striking is the influence of dissociation or of the incompleteness of the reactions yielding it. Such reactions are that of ammonium monosulphide with alcohol or acetone, or that obtained on heating potassium thiocyanate to redness, yielding the cyanate and sulphur. Nothing definite is known concerning the molecular structure of blue sulphur, but there are indications that the molecule is analogous to that of ozone and has the formula  $\text{S}_3$ ; the resemblance to ozone is also shown in the difficulty of preparation.

T. H. P.

**Theory and Practice of the Lead Chamber Process.** By GEORG LUNGE (*Zeit. angew. Chem.*, 1902, 15, 145—154).—In the present paper, the author criticises more especially the recent publications of T. Meyer (*ibid.*, 1901, 14, 1245) and of E. Loew (*ibid.*, 1900, 13, 338), as well as former attempts made by Hurter to apply the law of mass action to the reactions in the lead chamber. Such attempts have failed, to a large extent at least, for the reason that the reactions are not so simple as have been assumed, and also because the experimental investigation is as yet insufficient to supply the necessary ground-work on which to base the mathematical treatment. Moreover, mistakes have been made owing to insufficient acquaintance with the law of mass action and to disregard of intermediate reactions. The author restates his view that the reactions in the lead chambers consist first in the formation of nitrosylsulphonic acid, and that the latter is then decomposed by water into nitrous and sulphuric acids;

the former decomposes into water and oxides of nitrogen, which again form nitrosylsulphonic acid with sulphur dioxide. To the first reaction, the law of mass action cannot be applied, but the second, which is reversible, is susceptible of such treatment, and it should be possible to calculate the best conditions with regard to temperature and amount of water. The author also criticises the practical suggestions made by Meyer, and cannot see that they possess many advantages over the methods already existing.

A. F.

**Tellurium Tetrachloride.** By VICTOR LENHER (*J. Amer. Chem. Soc.*, 1902, 24, 188—190).—If tellurium is treated with excess of sulphur monochloride at the ordinary temperature, tellurium tetrachloride is produced; it may be purified by washing with carbon disulphide. When the vapour of sulphur monochloride is passed over strongly heated tellurium, the black tellurium dichloride is first formed, but rapidly changes into the tetrachloride, which is deposited in long needles on the cool parts of the tube.

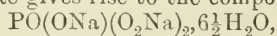
E. G.

**Ionic and Thermal Coefficients of Nitric Acid.** By VICTOR H. VELEY and J. J. MANLEY (*Phil. Mag.*, 1902, [vi], 3, 118—122).—From their previous determinations of the conductivity of nitric acid (Abstr., 1898, ii, 277), the authors have calculated the values of  $\mu/\mu_{\infty}$  at 15° for acid of 1.3 to 99.97 per cent. concentration. It is probable that the change in the temperature coefficient of conductivity at 96 per cent. concentration (*loc. cit.*) is connected with the formation of the compound  $2\text{HNO}_3 \cdot \text{N}_2\text{O}_5$ .

From their determinations of the density of nitric acid at different temperatures (Abstr., 1901, ii, 447), the authors have calculated the coefficient of thermal expansion. The coefficient increases with the concentration to  $1274 \times 10^{-6}$  for the 100 per cent. acid (temperature range 4—14°), a value 27 times as great as that of water. If the coefficients of thermal expansion are plotted against percentage composition, the resulting points lie approximately on four straight lines—firstly, from 1 to 8 per cent.; secondly, from 11 to 54 per cent.; thirdly, from 54 to 70 per cent.; fourthly, from 70 to 93 per cent.; the remainder lie on an irregular curve: it is noted that 54 per cent. is also the point of maximum contraction.

J. C. P.

**Action of Hydrogen Peroxide on Phosphates.** By G. I. PETRENKO (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 204—207).—When acted on by hydrogen peroxide, phosphoric acid does not yield a corresponding per-acid, but its salts give compounds in which the metal is partially replaced by the residue of a metallic peroxide. Thus, sodium phosphate gives rise to the compound



which is readily decomposed by water with formation of hydrogen peroxide. It is probable that ammonium phosphate forms a similarly constituted compound, but this could not be isolated owing to the readiness with which it loses ammonia and oxygen; compounds were separated in which the ratio P:O:NH<sub>3</sub> had the values 5:8:14 and 2:3:5.

T. H. P.

**Hydrazine Borates.** By A. DJAVACHOFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 227—230).—When boric acid solution is neutralised with hydrazine hydrate and the liquid evaporated partially on the water-bath and afterwards left in a desiccator over sulphuric acid, rhombic crystals are deposited which have the composition  $(\text{N}_2\text{H}_4)_2(\text{H}_2\text{B}_4\text{O}_7)_3 \cdot 10\text{H}_2\text{O}$ , and rapidly effloresce in the air. When kept in a vacuum over sulphuric acid until they attain a constant weight, these crystals lose water, the final composition being  $(\text{N}_2\text{H}_4)_2(\text{H}_2\text{B}_4\text{O}_7)_3 \cdot 5\text{H}_2\text{O}$ . On heating at  $100^\circ$ , the remaining  $5\text{H}_2\text{O}$  are given up, whilst at  $250$ — $260^\circ$  the compound assumes the composition  $(\text{N}_2\text{H}_4)_2(\text{B}_2\text{O}_3)_6$ . When heated above  $260^\circ$ , the last substance melts and is decomposed into hydrazine and boric oxide. Attempts to prepare crystalline borates of hydrazine other than the above have failed. T. H. P.

**Derivatives of Perboric Acid.** By G. I. PETRENKO (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 37—42).—The action of hydrogen peroxide on potassium fluoroborate yields a potassium fluoroperborate of the constitution,  $\text{K} \cdot \text{O} \cdot \text{O} \cdot \text{BF} \cdot \text{O} \cdot \text{O} \cdot \text{BF} \cdot \text{O} \cdot \text{K}$ ; with ammonium fluoroborate, the corresponding ammonium fluoroperborate is obtained together with ammonium perborate. Ammonium peroxide acts as a base towards perboric acid, with which it combines, giving a salt-like compound. T. H. P.

**Direct Hydrogenation of the Oxides of Carbon in the Presence of various finely-divided Metals.** By PAUL SABATIER and JEAN B. SENDERENS (*Compt. rend.*, 1902, 134, 689—691. Compare this vol., i, 333).—Although carbon monoxide is completely converted into methane by hydrogen in the presence of finely-divided nickel (*loc. cit.*) at  $250^\circ$ , at  $280^\circ$  another reaction becomes at the same time obvious, namely, the formation of carbon dioxide and very finely-divided carbon. Thus at  $380^\circ$ , carbon monoxide (1 vol.) and hydrogen (3 vols.) yield a gaseous mixture, which consists of carbon dioxide 10.5, methane 67.9, and hydrogen 21.6 per cent.; whilst when equal volumes of carbon monoxide and hydrogen (water gas) are used, 52.5 per cent. of carbon dioxide, 39.8 of methane, 7.1 of hydrogen, and 0.6 per cent. of carbon monoxide are formed.

Cobalt resembles nickel in its action on mixtures of carbon dioxide and hydrogen or carbon monoxide and hydrogen, but is less energetic; the reduction of carbon dioxide begins at  $300^\circ$  and is rapid at  $360$ — $400^\circ$ ; no formation of carbon or carbon monoxide, and no oxidation of the metal occurs. Carbon monoxide begins to be reduced at  $270^\circ$ , but at  $300^\circ$  the formation of carbon dioxide and carbon is also noticeable; the latter reaction plays a more prominent part the higher the temperature and the greater the proportion of carbon monoxide in the mixture of this gas and hydrogen, which is led over the cobalt. Platinum sponge and platinum black, palladium sponge and reduced iron, do not bring about the reduction of the oxides of carbon. Reduced copper converts a mixture of hydrogen and carbon dioxide into carbon monoxide and water at  $430^\circ$ . K. J. P. O.

**Action of Hydrogen Peroxide on Carbonates.** By P. KAZANEZKY (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 202—204).—Five grams

of freshly-prepared ammonium carbonate were dissolved in 40 c.c. of 20 per cent. hydrogen peroxide, and the solution, after cooling in ice, mixed with 5 c.c. of aqueous ammonia saturated at 0°. The addition to the liquid of 2—3 vols. of alcohol then gave a white, crystalline precipitate of a salt having the constitution  $\text{NH}_4 \cdot \text{O} \cdot \text{O} \cdot \text{CO} \cdot \text{O} \cdot \text{NH}_4, 2\text{H}_2\text{O}$ . The salt is readily soluble in water, by which it is almost completely decomposed into hydrogen peroxide and ammonium carbonate.

T. H. P.

**New Silicon Hydride.** By HENRI MOISSAN and S. SMILES (*Compt. rend.*, 1902, 134, 569—575).—The action of hydrochloric acid on the mixture of magnesium silicides obtained by heating magnesium and silicon together in the proportions Si : Mg<sub>2</sub>, yields hydrogen containing about 5 per cent. of silicon hydrides. If this mixture is passed through tubes cooled by liquid air or oxygen, the silicon hydrides solidify, and by allowing the solid to liquefy and volatilise fractionally the hydride Si<sub>3</sub>H<sub>6</sub> is obtained as a mobile, colourless liquid which boils at about 52°, takes fire spontaneously at the ordinary temperature, and burns brilliantly and even explosively, and is decomposed completely at about 250°. When solidified by means of liquid air, it melts at -138°. It is attacked by potassium hydroxide solution with liberation of hydrogen and formation of an alkali silicate, and it reduces solutions of mercuric chloride, auric chloride, and silver nitrate.

C. H. B.

**Solubility of Potassium Hydroxide in Water.** By P. FERCHLAND (*Zeit. anorg. Chem.*, 1902, 30, 130—133).—The concentration of a saturated solution of potassium hydroxide, prepared from electrolytic potassium amalgam, was found to be 51.76 per cent. at 15.8°, and 51.72 per cent. at 15°. The sp. gr. of the solution at 15° is 1.5355. One hundred parts of water dissolve 107 parts of potassium hydroxide. This result agrees with that of Pickering (*Abstr.*, 1894, ii, 308).

J. McC.

**New Sodium Phosphate.** By H. JOULIE (*Compt. rend.*, 1902, 134, 604—606).—When disodium phosphate is mixed with sufficient phosphoric acid solution of sp. gr. 1.35 to make it neutral to litmus, complete dissolution takes place and the temperature falls to -13°. If the liquid product is concentrated until a pellicle forms and is then heated at 45—50° for some time, it gradually deposits colourless, oblique prisms of sodium sesquiphosphate, Na<sub>3</sub>H<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>, which is not hygroscopic, but dissolves in water in all proportions. It is neutral to litmus, has a slightly saline taste, and by reason of its high solubility may form an advantageous means of administering phosphoric acid.

C. H. B.

**An Acid Monosodium Orthophosphate.** By H. GIRAU (*Compt. rend.*, 1902, 134, 711—713).—The crystals which frequently appear on the outside of the sticks of commercial metaphosphoric acid are shown to have the composition NaH<sub>2</sub>PO<sub>4</sub>·H<sub>3</sub>PO<sub>4</sub>; this very deliquescent substance is a definite salt, as its heat of dissolution in water, 1.12 Calories, differs from the heat of dissolution of a mixture of phosphoric acid and sodium dihydrogen phosphate, which amounts to 2.56 Calories (calculated). As commercial metaphosphoric acid has



approximately the composition  $\text{NaPO}_3, \text{HPO}_3$ , the above-mentioned salt appears to be formed by the fixation of two mols. of water. It is suggested that the salt described by Joulie (preceding abstract) is represented by the formula  $\text{Na}_3\text{PO}_4, \text{H}_3\text{PO}_4$ . K. J. P. O.

**Sesquisodium Phosphate.** By JEAN B. SENDERENS (*Compt. rend.*, 1902, 134, 713—714. Compare preceding abstracts).—It is pointed out that the salt  $\text{Na}_3\text{PO}_4, \text{H}_3\text{PO}_4$  described by Joulie is merely the anhydrous form of a salt previously described by the author (Abstr., 1882, 693), which, when air-dried, crystallises with  $15\text{H}_2\text{O}$ ; it loses  $12\text{H}_2\text{O}$  in an exhausted desiccator over sulphuric acid, and becomes anhydrous at  $110^\circ$ . K. J. P. O.

**Reactions occurring in Solutions employed for the combined Toning and Fixing of Prints on Silver Chloride-Citrate Paper and the Theory of this Operation.** By AUGUSTE LUMIÈRE, LOUIS LUMIÈRE and ALPHONSE SEYEWETZ (*Bull. Soc. Chim.*, 1902, [iii], 27, 137—153).—Employing Lumière's combined toning and fixing mixture, consisting of sodium thiosulphate, alum, lead acetate, and gold chloride, the authors have studied the different reactions which take place on dissolving that mixture in water, as well as the action which these substances and the products of their interaction have on the photographic image on silver chloride-citrate paper. On preparing the mixed solution of the four salts mentioned, a complex series of reactions occur, there being produced, together with other substances, aluminium sulphate and sodium hydrogen sulphite, sodium pentathionate, and hydrogen sulphide. From their study of the action of the different substances on the photographic image, the authors chiefly conclude that the lead, present as the double sodium lead thiosulphate, accelerates the replacement of silver in the print by gold. The place of lead in this case may be taken by other metals, although with less satisfactory results. Lead does not enter into the composition of the toned image. The chief value of the alum, besides its tanning action, appears to be that of giving rise to pentathionic acid with sodium thiosulphate, and it is shown that the addition of that acid or of its lead salt produces a more active toning bath. Excess of acid added to the toning and fixing bath in absence of lead produces as rapid toning as when lead is present, this effect being probably due to the formation of pentathionic acid. With a solution containing lead pentathionate but no gold, as fine tones can be produced as when gold is present.

A. F.

**Polyhalogen Compounds of the Alkaline Earth Metals.** By JULIUS MEYER (*Zeit. anorg. Chem.*, 1902, 30, 113—121).—The solubility of iodine in solutions of the alkaline earth haloids has been determined. One hundred c.c. of a 10 per cent. solution dissolve the following quantities of iodine (in grams):

	$\text{Cl}_2$	$\text{Br}_2$	$\text{I}_2$
Ba .....	0.067	0.231	6.541
Sr.....	0.066	0.270	6.616
Ca .....	0.078	3.274	8.062
Temp. ....	$18.5^\circ$	$13.5^\circ$	$13.5^\circ$

To decide whether the extra quantity of iodine was simply dissolved or chemically united, a cryoscopic method was used. Addition of iodine to a solution of barium iodide hardly depresses the freezing point, and the results are in agreement with the assumption that barium tetraiodide exists in the solution. Similar results were obtained with calcium and strontium iodides. These polyhalogen compounds are highly dissociated.

Calcium tetraiodide can be prepared by mixing calcium iodide and iodine (in mol. proportion) and warming on a water-bath. Between  $70^{\circ}$  and  $80^{\circ}$  the mixture melts, and on cooling a homogeneous, crystalline mass separates. Carbon disulphide or chloroform extracts two atoms of iodine. Barium and strontium tetraiodides can be prepared in the same way, but they are not so stable.

Crystalline masses the composition of which is represented by  $MI_6$ ,  $MI_8$ , and  $MI_{10}$  can also be obtained, but on dissolving them in water, iodine is separated with formation of tetraiodide. It has not been possible to isolate a tetrabromide.

The tetraiodides exist as such in solution, but the solids are best regarded as molecular compounds of  $MI_2$  and  $I_2$ . J. McC.

**Ammonium Calcium Phosphate.** By HENRI LASNE (*Bull. Soc. Chim.*, 1902, [iii], 27, 131—135).—The author confirms Barthé's statement (*Abstr.*, 1900, ii, 480) as to the non-existence of the ammonium barium phosphate described by Kippenberger. He shows, however, that ammonium calcium phosphate can be prepared by the action of ammonium phosphate on calcium chloride in presence of a sufficient quantity of ammonium citrate to prevent the precipitation of calcium phosphate from the ammoniacal solution. Too great a concentration of ammonia and of ammonium phosphate must be avoided. The salt is crystalline, and has the composition  $CaNH_4PO_4 \cdot 7H_2O$ . It is decomposed by cold water with formation of tricalcium phosphate and triammonium phosphate, but when heated with water other products appear also to be formed. A. F.

**Solubility of Calcium Carbonate in Aqueous Solutions of certain Electrolytes in Equilibrium with Atmospheric Air.** By FRANK K. CAMERON and ATHERTON SEIDELL (*J. Physical Chem.*, 1902, 6, 50—56. Compare Cameron and Briggs, this vol., ii, 64; Cameron, this vol., ii, 75; Cameron and Seidell, this vol., ii, 207).—The solubility curve of calcium carbonate in sodium chloride solution, in equilibrium with ordinary air, shows a maximum; the solutions contain no normal carbonates. Sodium sulphate markedly increases the solubility of calcium carbonate, and the resulting solutions contain both acid and normal carbonate; the solubility of the calcium carbonate increases with increasing concentration of sodium sulphate up to the point of saturation of the latter. The solubility curve of calcium carbonate in sodium chloride solutions, calcium sulphate being present in the solid phase, shows a break; in equilibrium with ordinary air, the solutions contain no normal carbonates. J. C. P.

**Calcium Silicide,  $CaSi_2$ .** By HENRI MOISSAN and W. DILTHEY (*Compt. rend.*, 1902, 134, 503—507; *Ber.*, 1902, 35, 1106—1110).—Calcium silicide was prepared by fusing calcium oxide with excess of

silicon in a carbon tube in an electric furnace; the fused mass consisted of calcium carbide and calcium silicate surrounding a nucleus of the silicide, generally containing a variable quantity of silicon. The silicide forms brilliant greyish, brittle crystals, having a sp. gr. 2.5; it takes fire in fluorine at the ordinary temperature, forming calcium fluoride and silicon fluoride; when heated to dull redness in chlorine, bromine, or iodine, it becomes incandescent, yielding the calcium and silicon haloids. When heated in air, the silicide is only superficially attacked, but in oxygen it burns, forming calcium oxide and silica. Sulphur and hydrogen sulphide attack it very superficially. When heated with carbon in the electric furnace, calcium and silicon carbides are formed. Fused copper does not dissolve the silicide; fused aluminium decomposes it, producing aluminium silicide; fused iron behaves similarly.

Water decomposes the silicide very slowly, giving silica and pure hydrogen. Concentrated sulphuric acid dissolves it with slight evolution of hydrogen. Dilute nitric acid attacks it slowly, forming silicon and evolving hydrogen. In hydrogen fluoride, the silicide becomes incandescent. Hydrogen chloride does not attack the silicide at the ordinary temperature, but at a red heat decomposes it with incandescence, forming the chlorides of silicon and calcium. Concentrated cold hydrochloric acid produces hydrogen, silicon hydride, and silicon, whilst the dilute acid gives with the silicide, hydrogen and a yellow substance. Solutions of alkalis very readily dissolve calcium silicide with the evolution of hydrogen.

K. J. P. O.

Formation of Oceanic Salt Deposits, particularly of the Stassfurt Beds. XXV. Formation of Langbeinite and its Lower Temperature Limits in the Salt Deposition at 37°. By JACOBUS H. VAN'T HOFF, WILHELM MEYERHOFFER, and F. G. COTTERELL (*Sitzungsber. K. Akad. Wiss. Berlin*, 1902, 276—282).—Langbeinite,  $K_2Mg_2(SO_4)_3$ , occurs in the polyhalite regions at Wilhelmshall and accompanies sylvite at Westeregeln. The most suitable langbeinite for dilatometric experiments is that obtained in the wet way, and this can best be prepared from magnesium and potassium sulphates and magnesium chloride by digestion on the water-bath.

Its formation from blödite,  $K_2Mg(SO_4)_2 \cdot 4H_2O$ , takes place at 89° as has been found by the dilatometer, and this was confirmed by observing the characteristic tetrahedral crystals when blödite was stirred in its saturated solution at 90°.

Presence of magnesium sulphate hexahydrate depresses the temperature of formation from blödite, and langbeinite is produced at 61°. This temperature may, however, be easily passed without the change taking place, and then at 72° the compound  $K_2Mg_4(SO_4)_5 \cdot 5H_2O$  (Abstr., 1900, ii, 284) is formed; this compound is unstable, for when langbeinite is added it is slowly converted into this.

In presence of sodium chloride, the temperature of formation may be still further depressed. The naturally accompanying minerals are magnesium sulphate hexahydrate, kainite, blödite, and sylvite, and it has

been proved that from a mixture of these langbeinite is formed at about 37°. Its occurrence along with sylvite indicates that it has been formed at a higher temperature than this. J. McC.

**Action of Hydrogen Peroxide on Zinc Oxide.** By ROBERT DE FORCRAND (*Compt. rend.*, 1902, 134, 601—604).—When zinc oxide is agitated for a long time with an excess of hydrogen peroxide, a *zinc peroxide*,  $\text{Zn}_4\text{O}_7$ , is obtained which is stable at the ordinary temperature and when dried approximates closely to the composition  $\text{Zn}_4\text{O}_7 \cdot 4\text{H}_2\text{O}$ . This represents the limit of oxidation under the conditions indicated, but if the partially dried product containing not less than 4.5 and not much more than  $5\text{H}_2\text{O}$  is treated with a fresh quantity of hydrogen peroxide, a product is obtained which approximates closely to  $\text{ZnO}_2$ , but is unstable even at the ordinary temperature. When the hydrated oxide,  $\text{Zn}_4\text{O}_7$ , is heated at 100°, it yields the oxide,  $\text{Zn}_3\text{O}_5 \cdot 3\text{H}_2\text{O}$ , already known. There is no evidence of the existence of an oxide between  $\text{ZnO}$  and  $\text{Zn}_3\text{O}_5$ , and the products obtained by Thenard and by Kouriloff seem to have been mixtures of the monoxide with one or more of the higher oxides,  $\text{Zn}_3\text{O}_5$ ,  $\text{Zn}_4\text{O}_7$ , or  $\text{ZnO}_2$ .

C. H. B.

**Electrolytic Production of Lead Dioxide.** CHEMISCHE FABRIK GRIESHEIM-ELEKTRON (D.R.-P 124512).—Lead dioxide is conveniently prepared by electrolysing a solution of an alkali chloride in which litharge is suspended. The dioxide is formed by the action of nascent chlorine and sodium hypochlorite on the soluble sodium plumbite, produced from the monoxide and the sodium hydroxide set free at the cathode, the reactions taking place in accordance with the following equations:  $\text{Pb}(\text{ONa})_2 + \text{NaOCl} + \text{H}_2\text{O} = \text{PbO}_2 + 2\text{NaOH} + \text{NaCl}$  and  $\text{Pb}(\text{ONa})_2 + 2\text{Cl} = \text{PbO}_2 + 2\text{NaCl}$ . Hydrogen is steadily evolved at the cathode, but there is no loss of chlorine at the anode. G. T. M.

**Compounds of Thallium.** By VICTOR THOMAS (*Compt. rend.*, 1902, 134, 545—547. Compare Cushman, *Amer. Chem. J.*, 1901, 26, 505).—Thallic chloride,  $\text{TlCl}_3$ , is quite stable in dilute solutions in presence of hydrochloric acid. Thallous chloride and bromine yield a *compound*,  $\text{TlClBr}_2 \cdot 4\text{H}_2\text{O}$  (?); on attempting to dehydrate this salt, the compound  $\text{Tl}_3\text{Cl}_2\text{Br}_4$  is always produced. Chlorine and thallous bromide give a *compound*,  $\text{TlCl}_2\text{Br} \cdot 4\text{H}_2\text{O}$ . Thallous bromide, suspended in water and treated with bromine, yields thallic bromide,  $\text{TlBr}_3 \cdot 4\text{H}_2\text{O}$ , crystallising in large, prismatic needles, which lose bromine readily with the formation of the dibromide. All these thallic halogen compounds form compounds with the halogen acids of the type,  $\text{TlX}_3 \cdot \text{HX}$ , which are extremely soluble in water and have not yet been obtained in a solid state. K. J. P. O.

**Some Complex Compounds of Thallium, and the Constitution of Double Salts.** By ALLERTON S. CUSHMAN (*Amer. Chem. J.*, 1901, 26, 505—518. Compare Abstr., 1900, ii, 725).—The author disputes the ground on which Meyer (Abstr., 1900, ii, 655) attributes to thallic chloride the formula  $\text{TlCl}_2\text{Cl}_2$ . The reason why Meyer did not find



that all the chlorine was precipitated by the Volhard method is that the thallic chloride oxidises some thiocyanate with production of potassium cyanide which prevents the complete precipitation of the silver chloride. The views previously expressed are maintained and the constitution of the various complex compounds of thallium chlorides with water are explained by the aid of quadrivalent oxygen.

Thallic chloride cannot be freed from water without undergoing reduction. Thallic chloride is easily soluble in ether, but the crystals separated from the solution have not the formula  $\text{TlCl}_3 \cdot (\text{Et})_2\text{O}$  assumed by Meyer, but  $\text{TlCl}_3 \cdot 4\text{H}_2\text{O}$ . J. McC.

**Theory of the Electrolytic Extraction of Copper.** By JACOB EGLI (*Zeit. anorg. Chem.*, 1902, 30, 18—85).—An historical account is given of the methods which have been proposed for the electrolytic extraction of copper from its ores and the disadvantages which are the causes of the non-success of these are pointed out. In connection with the Marchese process, the electrolytic extraction of copper sulphides by various solvents has been investigated, and in connection with the Höpfner process the electrolysis of cupric chloride solutions has been studied. An artificial cuprous sulphide containing some cupric sulphide was electrolytically extracted with sulphuric acid of sp. gr. 1.225 (acid of maximum conductivity). On electrolysis, the ore being made the anode, a slime is deposited on it which soon stops the current. This slime contains free sulphur, but it is shown from the analysis of the slime progressively deposited that the solution of the copper takes place in the two phases: (a)  $\text{Cu}_2\text{S} + \text{SO}_4^{--} = \text{CuSO}_4 + \text{CuS}$ , and (b)  $\text{CuS} + \text{SO}_4^{--} = \text{CuSO}_4 + \text{S}$ . Using current densities up to 30 amperes per sq. dm. the sulphur could not be oxidised. Rise of temperature favours the passage of the current. The same cuprous sulphide was electrolytically extracted with 4.5*N* sodium hydroxide, the sulphide in this case being the cathode. The sulphur passes into solution leaving metallic copper in the residual slime. Since the slime in this case has not a high resistance, the potential remains nearly constant throughout the electrolysis. The current yield is at first good but falls off, and it has further been observed that the current yield decreases as the current density rises. The cathodic slime can then be easily dissolved electrolytically in sulphuric acid, and as it contains little sulphur the previous disturbing factor is removed.

A preliminary experiment showed that cuprous sulphide is scarcely soluble in 5*N* hydrochloric acid, but when chlorine is passed into the acid, rapid solution takes place. The cuprous sulphide was made the anode in an electrolytic extraction with 5*N* hydrochloric acid, and it was found that the copper passes into solution and the sulphur is oxidised to sulphuric acid. The current yield (as measured by means of a copper voltameter) was found to be considerably more than 100 per cent. (rising to as much as 147 per cent.), and this indicates that even in presence of excess of free chlorine, which was found in the solution, the copper dissolves as cuprous chloride. From the analysis, it is calculated that about 53 per cent. of the dissolved copper existed as cuprous chloride. This has been confirmed by observing the actual formation of insoluble cuprous chloride when a more dilute (0.5*N*)

acid was employed. Cuprous chloride is formed too at all current densities. Addition of sodium chloride favours the electrolysis.

The electrolysis of cupric chloride was carried out with a solution of this substance using a platinum cathode and a carbon anode in a porous cell. When the solution is stirred, it is found that rapid stirring diminishes the yield for a given current, but the copper deposited is purer because the cuprous chloride formed by the dissolving of separated copper by the cupric chloride is washed away from the deposit. In a series of experiments, the solution circulated through the electrolytic cell and passed into another vessel containing a copper plate, and the rate at which the copper dissolved was measured. To obtain constant results, the liquid must always circulate at the same rate. Addition of hydrochloric acid diminishes the current yield, but leads to a pure copper, because the cuprous chloride formed is retained in solution. When the concentration of acid is very great, the current yield begins to increase slightly. Sodium chloride added to the solution also diminishes the current yield, but not to anything like the same extent as hydrochloric acid; the deposited copper is very pure. The current yield diminishes as the concentration of cupric chloride increases, and the copper deposited becomes more impure, for more cuprous chloride is formed, and it may even happen that cuprous chloride alone is deposited. It is not advisable, however, to diminish the concentration too much, for then the copper is deposited in a very spongy form. At a temperature of about  $12^{\circ}$ , the deposited copper is spongy; a coherent deposit is obtained at about  $25^{\circ}$ , but as the temperature rises above this, the current yield diminishes and the deposit is not so pure. Increase of current density slightly increases the current yield, because the solubility of the copper in the electrolyte is almost independent of this density. At very high current densities, however, the current yield falls on account of the separation of hydrogen at the cathode.

A deposit containing up to 99.98 per cent. of copper can be obtained from a solution containing 0.1 gram-mol. of cupric chloride, 0.1 gram-mol. of hydrochloric acid, and 0.4 gram-mol. of sodium chloride per litre.

J. McC.

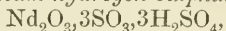
**Nature of Mercuric Iodide in Solution.** By J. H. KASTLE and JEWETT V. REED (*Amer. Chem. J.*, 1902, 27, 209—218. Compare Kastle and Clark, *Abstr.*, 1900, ii, 141).—When a saturated solution of mercuric iodide, prepared by heating the red modification in amyl alcohol at  $150^{\circ}$ , was cooled to  $118^{\circ}$ , red spots began to appear after about ten minutes among the yellow crystals which had previously separated; equilibrium, therefore, is not possible between the yellow variety of mercuric iodide and its saturated solution in amyl alcohol, even at  $10^{\circ}$  below the transition temperature ( $128^{\circ}$ ) of the compound. When, however, saturated solutions of mercuric iodide in naphthalene at  $140^{\circ}$  were cooled to  $100^{\circ}$ , no separation occurred. On addition of crystals of the red modification, the solution was not affected, but if yellow crystals were put into the solution a considerable quantity of yellow crystals immediately separated. The yellow iodide is also precipitated when other substances, such as powdered glass, are added to the

solution, whence it is seen that the separation of the yellow form does not depend only on the action of isomorphous crystals, but is also brought about by the disturbance of an unstable condition of equilibrium in the supersaturated solution of the iodide. These experiments confirm the conclusion previously arrived at, that solutions of mercuric iodide contain the yellow modification. It seems, therefore, that red mercuric iodide is insoluble in organic solvents and that the compound changes into the yellow variety as it passes into solution; this view is supported by the observation that the red modification dissolves more slowly in naphthalene than the yellow variety.

The stability of the yellow mercuric iodide which has separated from a solution varies greatly under different solvents; experiment has shown that the stability increases with the viscosity of the solvent, and that it is greater under vaseline than under any other solvent yet studied. This fact is readily explained, since in viscous solvents all chemical and physical changes are slow, sudden changes of temperature do not occur, and motion and friction of suspended particles are but slight.

E. G.

**Acid and Basic Sulphates of Neodymium and Praseodymium.** By CAMILLE MATIGNON (*Compt. rend.*, 1902, 134, 657—660).—The *neodymium hydrogen sulphate*,  $\text{Nd}(\text{HSO}_4)_3$  or



produced either by evaporating down a solution of the neodymium salt of a volatile acid with excess of sulphuric acid or by dissolving the normal sulphate in the boiling reagent and allowing the solution to cool, crystallises in long, silky, deliquescent, pink needles, which have an oblique extinction inclined at  $12^\circ$  to the principal axis. This form, however, rapidly becomes hydrated and changes into an aggregate of small, anisotropic crystals; finally, the normal salt with  $8\text{H}_2\text{O}$  is obtained mixed with excess of dilute sulphuric acid. One hundred parts of boiling concentrated sulphuric acid dissolve 1.30 parts of the acid salt. The heats of dissolution of the acid and normal sulphates in water at  $16^\circ$  are 64.20 and 37.2 Cal. respectively, the heat of formation of the former from the latter being 26.3 Cal.

The *basic neodymium sulphate*,  $(\text{NdO})_2\text{SO}_4$  or  $\text{Nd}_2\text{O}_3 \cdot \text{SO}_3$ , obtained by gently igniting the normal salt, is an insoluble, amorphous, pink powder stable at  $1000^\circ$ .

The *praseodymium hydrogen sulphate*,  $\text{Pr}(\text{HSO}_4)_3$ , prepared in a similar manner to the corresponding neodymium salt, is isomorphous with this substance, separating in slender needles having oblique extinction; 100 parts of boiling concentrated sulphuric acid dissolve only 1.02 parts of the compound. The heats of dissolution of the acid and normal sulphates in water at  $16^\circ$  are 65.5 and 36.0 Cal. respectively, the heat of formation of the former from the latter being 24.2 Cal. The acid praseodymium salt is less stable than its neodymium analogue, and is more readily decomposed on heating.

The *basic praseodymium sulphate*  $(\text{PrO})_2\text{SO}_4$ , produced by igniting the normal salt at  $1000^\circ$ , is a pale green, insoluble, amorphous powder.

G. T. M.

**Crystalline Forms of Sulphates of Neodymium, Praseodymium, and Samarium.** By HENRI DUFET (*Chem. Centr.*, 1902, i, 452; from *Bull. Soc. franç. Min.*, 24, 373—403. Compare Fock, *Zeit. Kryst. Min.*, 32, 251, and Kraus, *Abstr.*, 1901, ii, 453).—Neodymium sulphate,  $\text{Nd}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$ , praseodymium sulphate,  $\text{Pr}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$ , and samarium sulphate,  $\text{Sa}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$ , are isomorphous and separate in monoclinic crystals. A crystallographic examination of the sulphates prepared by Chenal and Donilhet gave the following data [ $a:b:c = 0.99465:1:0.88093$ ;  $\beta = 88^\circ 17' 0''$ ], [ $a:b:c = 0.99026:1:0.88278$ ;  $\beta = 88^\circ 24' 10''$ ], and [ $a:b:c = 1.00103:1:0.88192$ ;  $\beta = 88^\circ 16' 40''$ ] respectively. A spectroscopic examination of the salts showed their extreme purity. E. W. W.

**Crystallisation of Peroxide of Iron.** By ALFRED DITTE (*Compt. rend.*, 1902, 134, 507—512).—The author has studied the production of crystalline peroxide of iron when hydrated ferrous sulphate and sodium chloride are fused together, and has shown that the formation of crystals is effected by an interaction between water, hydrogen chloride, and ferrous chloride (as vapour); if the fusion is carried out in an open crucible, little crystalline peroxide of iron is formed. If a little potassium fluoride is added to the mixture, the hydrogen fluoride thus produced greatly aids the production of crystals. The sulphates of nickel, cobalt, and manganese do not yield crystalline oxides when similarly treated, probably because these sulphates become anhydrous at a temperature far below their points of decomposition, whilst ferrous sulphate loses its water of crystallisation only just before it begins to decompose. K. J. P. O.

**Specific Heat and Atomic Weight of Vanadium.** By CAMILLE MATIGNON and E. MONNET (*Compt. rend.*, 1902, 134, 542—545).—Ferrovanadium, obtained by reducing a mixture of iron oxide and vanadic oxide by means of aluminium, is a brilliantly white alloy of fibrous structure, very easily soluble in dilute acids, and capable of imparting a green coloration to water. The specific heat of the alloy between  $15^\circ$  and  $100^\circ$  is 0.1185; from this value, the specific heat of vanadium can be calculated by Regnault's rule, and is 0.1258; the atomic heat is then 6.4, when  $V = 51$ .

The specific heat of aluminium-vanadium is 0.1565; the specific heat of vanadium, calculated from this value, is 0.1235, and the atomic heat 6.3.

Vanadium is very accurately estimated by reducing vanadic compounds, by means of sulphurous acid, to hypovanadic oxide,  $\text{V}_2\text{O}_4$ , and titrating the latter with standard potassium permanganate.

K. J. P. O.

**Thermochemistry of the Action of Hydrogen Peroxide on Vanadates and Pervanadates.** By L. PISSARJEWSKY (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 210—216).—The results obtained by the author for the amounts of heat developed by the interaction of potassium vanadate with different proportions of hydrogen peroxide in aqueous solution are as follows:



Mol. of $\text{KVO}_3$ .	Mols. of $\text{H}_2\text{O}_2$ .	Heat developed.
1	1	9.024 Cal.
1	2	17.772 „
1	$3\frac{1}{2}$	17.731 „
1	4	17.521 „

Increase in the amount of hydrogen peroxide beyond 2 mols. to one of the vanadate has thus no influence on the heat developed. Allowing for the heat of formation of hydrogen peroxide from water and oxygen (23,100 Cal.), the heat of formation of potassium pervanadate from the vanadate and oxygen is represented by the equation  $\text{KVO}_3 + \text{O} = \text{KVO}_4 - 14,076 \text{ Cal.}$  Besides the compound  $\text{KVO}_4$ , in which the ratio of V : active oxygen = 1 : 1, there exists in aqueous solution a more highly oxidised compound, in which V : active oxygen = 1 : 2, and this is either a salt of the composition  $\text{KVO}_5$  or a double compound of the composition  $\text{KVO}_4 \cdot \text{H}_2\text{O}_2$ . The last, like the similar compound formed by molybdic acid and having the composition  $\text{MoO}_3 \cdot 2\text{H}_2\text{O}_2$ , is not resolved in solution into hydrogen peroxide and the corresponding acid, but such resolution takes place to a considerable extent with the compound formed by tungstic acid with hydrogen peroxide.

T. H. P.

## Mineralogical Chemistry.

**Occurrence of Free Sulphur in Beaumont Petroleum.** By CLIFFORD RICHARDSON and EDWIN C. WALLACE (*J. Soc. Chem. Ind.*, 1902, 21, 316—317).—The limestone in which this petroleum occurs contains crystals of sulphur. Its presence explains that of the hydrogen sulphide of the crude oil and the fact that, after removing this by a current of air, it is again formed by heating the oil to 200°.

By passing the oil through a Day's kaolin filter, several fractions are obtained greatly differing in colour, specific gravity, and percentage of sulphur. The most remarkable fact is, however, that the denser fractions, particularly the second, on standing for about one month deposit regular crystals of sulphur.

L. DE K.

**Analyses of Bulgarian Minerals.** By FRANTIŠEK KOVÁŘ (*Jahrb. Min.*, 1901, ii, Ref. 362—364; from *Rozpravy České Akad. [Mem. Bohemian Acad.]*, 1900, No. 37, 20 pp.).—1, Spessartite, as reddish grains, sp. gr. 4.19, from a block composed of pyroxene, tremolite and metallic ores (pyrites, magnetite, alabandite) from the Rhodope mountains:

$\text{SiO}_2$ .	$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	$\text{FeO}$ .	$\text{MnO}$ .	$\text{CaO}$ .	$\text{MgO}$ .	Total.
37.02	18.83	1.26	6.15	34.57	0.76	1.19	99.78

II, A black, magnetic ore, sp. gr. 4·67, from the gneiss at Debarštica, has, according to analyses II and IIa, the formula  $(\text{Fe}, \text{Mg})(\text{Fe}, \text{Mn})_2\text{O}_4$ , and is therefore referred to jacobsite :

	Fe.	Mn.	Mg.	Ca.	Insol.	O.	Total.
II.	46·38	19·63	3·46	trace	1·72	[28·81]	100·00
IIa.	45·58	19·29	3·40	trace	3·07	[28·66]	100·00

Chromite from the Rhodope Mountains; analysis III of material as mined in the serpentine, IIIa of material from the river-sands :

	$\text{Cr}_2\text{O}_3$ .	$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	FeO.	MnO.	MgO.	CaO.	$\text{SiO}_2$ .	Total.	Sp.gr.
III.	51·05	9·76	—	27·07	trace	8·98	trace	(2·80 serpentine)	99·66	4·49
IIIa.	53·07	10·83	10·27	8·71	—	16·76	0·22	0·35	100·21	4·42

IV, Chrysotile veins in the serpentine of the last-named locality.  
V, Lamellar serpentine :

	$\text{SiO}_2$ .	$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	FeO.	MnO.	CaO.	MgO.	$\text{H}_2\text{O}$ .	Total.	Sp.gr.
IV.	42·85	0·38	—	2·66	—	0·62	40·23	13·06	99·80	2·51
V.	41·84	0·92	—	2·46	—	trace	40·80	14·19	100·21	2·45
VI.	38·06	22·05	15·18	—	trace	23·06	nil	1·82	100·17	—
VIa.	38·79	26·12	10·33	—	trace	23·30	trace	1·90	100·44	—

VI, prismatic crystals and VIa, columnar aggregates of epidote from crevices in syenite at Phillippopel. L. J. S.

Gibbsite from India. By H. WARTH (*Min. Mag.*, 1902, 13, 172—173; and *Centr. Min.*, 1902, 176—179).—Beneath the soil which covers the gray, igneous rocks of the Palni Hills in the Madura district of the Madras Presidency, there is a loose bed, about one foot in thickness, of a mineral which is shown by the following analysis (I) to be gibbsite,  $(\text{Al}_2\text{O}_3, 3\text{H}_2\text{O})$ . It is amorphous, and takes the form of nodular plates. In colour it is nearly white with a cream or reddish tint; sp. gr. 2·42. It dissolves easily in hot sulphuric acid and in hot sodium hydroxide solution; less perfectly in hot hydrochloric acid. The mineral has probably been formed by the action of percolating water containing carbon dioxide on alkali aluminate, the latter having been derived from the weathering of the underlying igneous rock :

	$\text{H}_2\text{O}$ .	$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	CaO.	MgO.	$\text{TiO}_2$ .	$\text{SiO}_2$ .	Total.
I.	33·74	62·80	0·44	0·20	0·03	0·04	2·78	100·03
II.	16·2	37·3	2·5	0·9	—	—	41·8*	98·7

The second paper gives, in addition, an account of a mineral which occurs abundantly as white nodules in the more or less decomposed igneous rock of the Palni Hills. In composition (anal. II) it is near to kaolin, but it is not plastic like ordinary kaolin, and is more readily attacked by hydrochloric acid than is the latter. L. J. S.

Occurrence of Chrompicotite in Canada. By G. CHRISTIAN HOFFMANN (*Amer. J. Sci.*, 1902, [iv], 13, 242—243).—Chrompicotite, hitherto known only from Dun Mountain in New Zealand, has recently

\* Including 2·0 per cent. crystalline silica, and 0·6 per cent. free amorphous silica.

been found in considerable quantity as veins in serpentine on Scottie Creek in the Lillooet district, British Columbia. It is massive, with a coarse, granular structure and a velvet-black colour. In very thin sections it is translucent with a brownish-red colour. Sp. gr. 4.239. Analysis by R. A. Johnston gave :

$\text{Cr}_2\text{O}_3$ .	$\text{Al}_2\text{O}_3$ .	FeO.	MgO.	$\text{SiO}_2$ .	Total.
55.90	13.83	14.64	15.01	0.60	99.98

L. J. S.

Analyses [of Dolomite, Ankerite, Forsterite, and Titanomagnetite]. By H. ARSANDAUX (*Bull. Soc. franç. Min.*, 1901, 24, 472—476).—I, Dolomite in Triassic marls at Djelfa, Algeria. II, Dolomite crystals in Triassic gypsum from Haidérenia near Cambo, Basses-Pyrénées. III, Dolomite as drusy crystals lining crevices in dolomite interlaminated with crystallised schists at Vieilleville, Loire-Inférieure. IV, Ankerite crystals with quartz and siderite from Saint Pierre, Allard : this enclosed veins of calcite which was separated before analysis :

	CaO.	FeO.	MnO.	MgO.	$\text{CO}_2$ .	Total.	Sp. gr.
I.	30.0	2.7	0.6	19.6	46.8	99.7	2.889
II.	30.3	0.9	0.6	20.8	47.8	100.4	2.872
III.	30.0	4.0	0.6	18.7	46.6	99.9	2.910
IV.	28.2	17.2	traces	10.9	42.5	98.8	3.025

All four analyses lead to the formula  $\text{CaCO}_3(\text{Mg}, \text{Fe}, \text{Mn})\text{CO}_3$ .

V, Forsterite from Kandy, Ceylon ; this constitutes the bulk of a compact, greenish-yellow, waxy rock ; small amounts of calcite, phlogopite and serpentinous decomposition products were separated from the material before analysis :

	$\text{SiO}_2$ .	FeO.	MgO.	$\text{TiO}_2$ .	$\text{Fe}_2\text{O}_3$ .	MnO.	Total.	Sp. gr.
V.	42.8	2.6	55.4	—	—	—	100.8	3.248
VI.	—	34.5	0.5	5.3	57.7	0.9	98.9	5.065

VI, titanomagnetite, as magnetic octahedra, from Cronstet, near Le Puy, Haute-Loire : formula,  $(\text{FeO}, \text{TiO}_2, \text{Fe}_2\text{O}_3)(\text{Fe}, \text{Mn}, \text{Mg})\text{O}$ .

L. J. S.

[Analyses of Strontianite and Spodumene.] By FRANTIŠEK KOVÁŘ (*Jahrb. Min.*, 1901, ii, Ref. 364 ; from *Zeit. Chem. Ind. Prag*, 1900, 6 pp.).—Strontianite as hemispherical, radially fibrous masses occurs with calcite and analcite in cavities in the nepheline-tephrite of Mt. Kunětice, near Pardubitz, Bohemia. Analysis gave :

$\text{CO}_2$ .	SrO.	CaO.	FeO.	$\text{H}_2\text{O}$ .	Insol.
30.67	65.06	3.81	trace	0.09	0.12

Spodumene, as white, very fine needles, occurs in fibrous calcite from Čichov, Moravia ; it was observed as an insoluble residue when the calcite was dissolved. Analysis gave :

$\text{SiO}_2$ .	$\text{Al}_2\text{O}_3$ .	FeO.	CaO.	MgO.	$\text{Li}_2\text{O}$ .	$\text{Na}_2\text{O}$ .	$\text{H}_2\text{O}$ .	Total.
62.70	27.88	0.85	0.29	0.11	5.84	1.78	0.26	99.71

At the same locality, spodumene also occurs as large lamellar masses in crystalline limestone.

The paper also gives the results of analyses of limburgite and limestones. L. J. S.

"Bitter-spars." By K. EISENHUTH (*Zeit. Kryst. Min.*, 1902, **35**, 582—607).—Results are given of detailed determinations of the chemical composition, sp. gr., rhombohedral angle and refractive indices of thirty-five specimens of "bitter-spar," mainly from the talc- and chlorite-schists of the Alps. These rhombohedral carbonates, although similar in general appearance, include dolomite, magnesite, breunnerite, calcite, manganiferous dolomite and "brown-spar." In the dolomites, the amount of calcium remains constant, and the formula is  $\text{Ca}(\text{Mg}, \text{Fe}, \text{Mn})(\text{CO}_3)_2$ . The tabulated results show that an increase in the amount of iron in the series is accompanied by an increase in the sp. gr. and the refractive indices, whilst the rhombohedral angle becomes more obtuse. It is shown that magnesite, as well as dolomite, occurs in the Zillerthal and in the Pfitschthal, Tyrol. L. J. S.

[Ankerite from Montana.] By WALTER HARVEY WEED (*20th Ann. Rep. U.S. Geol. Survey*, for 1898—1899, 1900, Part III., 409).—The following mineral analyses are given in a monograph (pp. 257—581) on the geology of the Little Belt Mountains, Montana. These are of ankerite, which occurs abundantly as a gangue in the mineral veins of this region. It is coarsely crystalline, and white, or very pale brown or pink; in cavities there are rosette-like aggregates of small, rhombohedral crystals:

$\text{FeCO}_3$ .	$\text{MnCO}_3$ .	$\text{CaCO}_3$ .	$\text{MgCO}_3$ .	Total.	Insol. in HCl (deducted).
26.55	41.26	15.08	17.11	100.00	12.76
15.34	20.62	43.00	21.04	100.00	14.34

The same paper gives the results of many rock analyses. L. J. S.

Apatite from Minot, Maine. By JOHN E. WOLFF and CHARLES PALACHE (*Proc. Amer. Acad. Arts and Sci.*, 1902, **37**, 517—528).—A description is given of excellent crystals of transparent, rich purple apatite found associated with quartz, orthoclase, lepidolite, &c., in a cavity in pegmatite at Minot, Maine. As shown by the following analysis, the mineral is fluor-apatite without chlorine: formula,  $\text{Ca}_5(\text{F}, \text{OH})(\text{PO}_4)_3$ . At a temperature of  $320^\circ$ , the crystals become colourless or faintly yellow, the loss of colour being accompanied by decrepitation, phosphorescence and a petroleum-like odour:

$\text{P}_2\text{O}_5$ .	$(\text{Fe}, \text{Al})_2\text{O}_3$ .	$\text{MnO}$ .	$\text{CaO}$ .	$\text{MgO}$ .	$\text{K}_2\text{O}$ .	$\text{Na}_2\text{O}$ .	$\text{H}_2\text{O}$ .	F.	Loss at $520^\circ$ .	Total less O for F.
41.30	0.71	0.85	53.43	0.70	0.27	0.36	0.29	2.38	0.04	99.33

The axial ratio ( $c = 0.7348$ ) and the birefringence ( $\omega - \epsilon = 0.0020$ ) are lower than any hitherto recorded for apatite. Sp. gr. = 3.159. A table comparing the numerical values of these physical characters with the percentages of chlorine and fluorine in various apatites indicates that sufficient data have not, as yet, been determined to allow of any



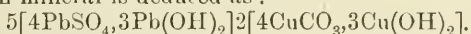
conclusions being drawn as to inter-relations between the physical and chemical characters of apatite. L. J. S.

**Occurrence of Monazite in Iron-ore and in Graphite.** By ORVILLE A. DERBY (*Amer. J. Sci.*, 1902, [iv], 13, 211—212).—Numerous crystallised grains of corundum, monazite and zircon were found enclosed in a specimen of magnetic iron-ore (consisting of a mixture of magnetite and ilmenite) from Brazil. Abundant grains of monazite and zircon were also found in graphite from two Brazilian localities. L. J. S.

**Caledonite from Chili.** By GEORG BERG (*Tschermak Min. Mitth.*, 1901, 20, 390—398).—On specimens of the upper oxidised ores from the silver mines of Challacollo in the desert of Atacama, small crystals of caledonite were noticed associated with chessylite and quartz. In colour, these are of a deep sky-blue, instead of greenish or bluish-green as is usual in caledonite. Analysis gave (after deducting 2·31 per cent. insoluble material consisting mainly of quartz):

PbO.	SO <sub>3</sub> .	CuO.	CO <sub>2</sub> .	H <sub>2</sub> O.
69·18	14·15	9·73	3·16	3·78

The material was quite homogeneous, and the carbon dioxide is not due to admixture of cerussite as previously supposed. Pure splinters of the Scotch caledonite were found to effervesce in acid. The formula for the Chilian mineral is deduced as:



From previously published analyses of the Scotch mineral, the formula,  $4[(\text{Pb}, \text{Cu})(\text{SO}_4, \text{CO}_3)], 3[(\text{Pb}, \text{Cu})(\text{OH})_2]$ , is deduced. L. J. S.

**Schneebergite.** By RUDOLF KOECHLIN (*Tschermak Min. Mitth.*, 1902, 21, 15—22).—Schneebergite was described by Brezina (Abstr., 1882, 150) as a cubic mineral consisting mainly of antimony and calcium together with a little iron. Later it was considered by Eakle and Muthmann (Abstr., 1895, ii, 512) to be only garnet (topazolite). It is now shown that schneebergite (that is, a mineral answering to Brezina's description) and garnet occur together at Schneeberg in the Tyrol. The schneebergite occurs always as octahedra, and the garnet only in grains; the former is infusible before the blowpipe, and the latter fusible. Quantitative analysis of schneebergite showed the presence of antimony, calcium, iron, also bismuth, aluminium, magnesium, potassium, sodium, and traces of arsenic, tin and lead. The following quantitative determinations were made: CaO, 20·14 and 19·91; Fe<sub>2</sub>O<sub>3</sub> + Al<sub>2</sub>O<sub>3</sub>, 8·48; MgO, 0·18 per cent. The refractive index of schneebergite was determined by C. Hlawatsch to be about 2·10.

L. J. S.

**[Lepidolite] from Brassac (Tarn).** By H. ARSANDAUX (*Bull. Soc. franç. Min.*, 1901, 24, 428—432).—The gneiss in the neighbourhood of Brassac is penetrated by veins of granulate and pegmatite in which are garnets and tourmaline. Where the pegmatite has been altered by pneumatolytic action, the lithia-bearing minerals, rubellite (sp. gr. 2·99) and lepidolite, together with apatite have been developed. Sometimes

pseudomorphs after orthoclase consist entirely of a mixture of quartz, rubellite and lepidolite. The lepidolite is present as purplish-violet or pearly-white scales 4 mm. across; analysis gave:

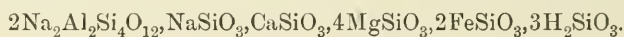
SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	MnO.	(K,Rb,Cs) <sub>2</sub> O.	Li <sub>2</sub> O.	H <sub>2</sub> O.	F.	Total less O for F
51.0	26.2	traces	11.4	5.9	2.2	6.2	100.3

L. J. S.

**Glaucophane from Chateyrroux (Gressoney Valley).** By FERRUCCIO ZAMBONINI (*Atti R. Accad. Lincei*, 1902, 11, i, 204—208).—The author describes some shining, black glaucophane crystals showing the forms {110}, {010} and {111}. Analysis gave the following results:

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Total.
55.43	12.26	8.07	2.91	8.67	9.02	2.87	99.23

These numbers correspond with those required for the formula:



T. II. P.

**Felspar from Southern Bohemia.** By J. V. ZELIZKO (*Jahrb. Min.*, 1901, ii, Ref. 353; from *Oesterr. Zeit. Berg u. Hüttenw.*, 1900, 48, 7 pp.).—The following analysis of felspar is given in an account of the industry of winning felspar and quartz at various places in the south of Bohemia. The melting point of the felspar is 1420°:

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	CaO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	MgO.	Fe <sub>2</sub> O <sub>3</sub> .	Total.
67.95	18.60	0.47	9.60	3.16	0.09	trace	99.87

L. J. S.

**Phonolites of Spitzberg, Bohemia.** By HERMANN TRENKLER (*Tschermak Min. Mitth.*, 1901, 20, 129—177).—A petrographical description of the phonolites of the Spitzberg near Brüx, Bohemia, contains the following mineral analyses. I, basaltic hornblende; II, aegirite. Under III is given the composition of the phonolite from which these minerals were isolated.

	SiO <sub>2</sub> .	TiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	MnO.	CaO.	MgO.	Na <sub>2</sub> O.	K <sub>2</sub> O.	H <sub>2</sub> O.	Total.
I.	44.05	3.26	14.83	7.12	3.20	—	12.15	12.37	4.08	—	—	101.06
II.	51.75	trace	1.82	23.13	7.01	1.11	5.01	2.09	6.32	1.03	0.71	99.98

III.	56.13	0.81	23.01	1.06	0.18	1.98	1.88	8.67	3.57	2.22	—	
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	ZrO <sub>2</sub> .	(Ce,La,Di) <sub>2</sub> O <sub>3</sub> .	Cl.	SO <sub>3</sub> .	P <sub>2</sub> O <sub>5</sub> .	CO <sub>2</sub> .	Cu.	Pb.	Su.	Sb.	As.
III.	0.02	0.03	0.12	0.05	0.03					traces	

99.56

An account, illustrated with figures of apparatus, is given of the methods employed in separating the minerals of such fine-grained rocks.

L. J. S.

**Density of Fluid and Solid Magmas.** By CORNELIUS DOELTER (*Jahrb. Min.*, 1901, ii, 141—157).—In connection with theories of volcanic action, it is often necessary to know the relative densities of molten and solid rocks and minerals. A summary of the results now obtained is given in the following table. The sp. gr. of the molten

magmas was determined by means of mineral indicators, it being noted which minerals floated and which sank in the magma.

	Natural product.	After ignition.	Fluid.	Rapidly cooled (glassy).	Slowly cooled (crystalline).
Melanite .....	3.75	—	3.55—3.6	3.55—3.60	3.65 —3.7
Augite.....	3.29—3.3	—	2.92	2.92—2.95	3.2 —3.25
Limburgite.....	2.83	2.85—2.88	2.55—2.568	2.55—2.568	2.75 —2.78
Lava, Etna.....	2.83	2.84	2.586—2.74	2.71—2.75	2.81 —2.83
„ Vesuvius ...	2.83—2.85	2.84—2.87	2.68—2.74	2.69—2.75	2.775—2.81
Nephelinite.....	2.735—2.745	2.75	2.70—2.75	2.686	2.72 —2.75
Leucitite.....	2.83	—	2.60—2.68	2.68—2.72	2.75 —2.787

It will be seen from these figures that in all cases the sp. gr. of the molten magma is considerably less than that of the solid crystalline material, but only slightly less than of the solid glassy material.

L. J. S.

**Meteoric Iron from Guatemala.** By STANISLAS MEUNIER (*Compt. rend.*, 1902, 134, 755—756).—A mass of meteoric iron weighing 5.720 kilograms was found in Guatemala in 1901. The structure is lamellar and wanting in compactness; sp. gr. 7.160. Analysis gave:

Fe.	Ni.	Co.	FeS.	Schreibersite.	Total.
89.991	9.052	trace	0.413	0.684	100.170

It belongs to the same type as the Schwetz (Prussia) iron.

L. J. S.

## Physiological Chemistry.

**Effects of Potassium Cyanide and of Lack of Oxygen on the Fertilised Eggs and Embryos of the Sea Urchin (*Arbacia Punctulata*).** By E. P. LYON (*Amer. J. Physiol.*, 1902, 7, 56—75).—Development is slightly hastened in very weak solutions of potassium cyanide, but there is a loss of resistance to the poison during development, probably with each cleavage. Prolonged exposure to the poison weakens the union of the cells, and on transference to sea-water the cilia recover, and the cells swim apart. Lack of oxygen produces the same result. Some degree of immunity can be induced by raising the embryos from the start in very weak solutions.

W. D. H.

**Embryo-chemical Investigations.** By P. A. LEVENE (*Zeit. physiol. Chem.*, 1902, 35, 80—83).—The proportion of the different combinations of nitrogen varies with the development of the egg; the following numbers are from experiments on fishes eggs:

	Percentage of total nitrogen.			
	Eggs not incubated.	Incubated for		
		1 day.	10 days.	19 days.
Nitrogen in substances not precipitable by phosphotungstic acid	21.10	21.37	22.72	—
Nitrogen in non-proteid substances precipitable by phosphotungstic acid.....	12.07	25.10	12.48	28.25
Nitrogen in proteids .....	66.00	53.57	64.79	71.84

Hen's eggs incubated for 7 days contain in the yolk monoamino-acids. The analyses given make it probable that there is a mixture of aminobutyric and aminovaleric acids in molecular proportion. W. D. H.

**Hæmoglobin during the Period of Suckling.** By EMIL ABDERHALDEN (*Zeit. physiol. Chem.*, 1902, 34, 500—516).—The absolute quantity of hæmoglobin is smallest at birth, and gradually increases; the increase is rapid when milk is replaced by a diet rich in iron. The relative quantity of hæmoglobin is highest at birth, and gradually falls to the end of the suckling period, when with the new diet it rapidly rises. The amount of iron not present in hæmoglobin is at its maximum about the period of birth, and then falls daily with the increasing absolute amount of hæmoglobin. The tissues, especially the liver and spleen, give a marked iron reaction at birth, the intensity of which lessens daily and practically disappears at the time of weaning. W. D. H.

**Hæmolysis.** By MAX MATTHES (*Chem. Centr.*, 1902, i, 766; from *Münch. Med. Woch.*, 49, 8—10).—Blood corpuscles repeatedly washed in the centrifuge with isotonic salt solution are resistant to pancreatic digestion, and settle with little or no agglutination. If the corpuscles are killed previously with Hayem's sublimate solution, digestion occurs. The same result is noticed with neutralised gastric juice. Rabbit's blood-serum from an animal treated with guinea-pig's blood, which acts hæmolytically on guinea pig's blood, does not lose its hæmolytic properties after pancreatic digestion. The hæmolytic serum itself possesses proteolytic properties. Experiments with heated immune serum show that treatment of the blood corpuscles with immune substance does not kill them or render them digestible by pancreatic juice, but a marked agglutination of the corpuscles is noted. Heating inactive serum for half-an-hour at 56° produces an agglutinating substance, but subsequent treatment with pancreatic juice renders the agglutinating action more apparent. In the serum, substances are present which are able to dissolve the hæmoglobin from the corresponding killed corpuscles; this power is lessened by heat. W. D. H.

**The Inhibition of Hæmolysis by Salts.** By MARKL (*Chem. Centr.*, 1902, i, 730; from *Zeit. Hygiene*, 39, 86—92).—Following up



the work of Hamburger and of Gryn's and Hedin, Nolf (Abstr., 1901, ii, 256) has advanced the hypothesis that chemical substances which act hæmolytically do so by producing a hydration of the cells and their membranes, so increasing the permeability of the latter towards hæmoglobin; he finds no evidence of the fermentative nature of the action of alexins on blood corpuscles. Concentrated solutions of such salts, as sodium chloride, potassium iodide, and nitrate, diminish the hæmolytic action of alexins by lowering the permeability of the cell-membranes. Hæmolytic immune serums act by favouring the fixation of alexins in the cells. Pohl, on the other hand (*Arch. internat. Pharmacodyn. Thérap.*, 7, Nos. 1 and 2), has observed that normal serum protects blood corpuscles from poisonous doses of solanine, and considers that this action is not purely physical, as proteid or gum solutions of 2 per cent. strength are as indifferent as physiological saline solution. Solanine increases the hæmolytic action of the serum tenfold; Pohl considers that the protective substance is acid sodium phosphate, for with this salt alone an absolute protection against fifty toxic doses of solanine is obtained. Towards saponin and ichthyotoxin, however, the acid salt is inactive.

The present investigation is concerned with the question whether acid sodium phosphate influences the hæmolysis produced by normal and immune serum. The action of hæmolytic serum only occurs when there is a definite relationship between serum and blood and the anti-hæmolytic action of the acid phosphate is dependent on a definite relationship between this salt and the blood and serum. The concentration of the salt, the temperature and concentration of the blood, are all factors to be considered; high temperature and low concentration of the blood favour hæmolysis; low temperature and high concentration of the blood favour the anti-hæmolytic action of the phosphate. The phosphate, therefore, alters the osmotic relationships of the membranes of the red corpuscles, so that the alexins cannot obtain a footing. This explanation agrees well with Nolf's physical theory.

W. D. H.

**Digestion in the Small Intestine.** By FR. KUTSCHER and J. SEEMANN (*Zeit. physiol. Chem.*, 1902, 34, 528—543).—Normally, tryptic digestion in the intestine breaks up an important part of the proteids into crystalline products, of which leucine, tyrosine, lysine, and arginine were isolated. These products are so changed in their passage through the intestinal wall as to be lost. Proteoses and peptone could not be identified in noteworthy amounts in the intestinal contents.

W. D. H.

**Digestion of Sucrose.** By J. H. WIDDICOMBE (*J. Physiol.*, 1902, 28, 175—180).—The inverting action of intestinal mucous membrane is suspended, but not destroyed, by acid. The portions free from Peyer's patches are more active than those containing the patches. Saliva and extracts of lymph glands have no action on sucrose. The gastric mucous membrane and its juice contain an inverting enzyme, which is active in an acid medium only; the inverting action of the acid of the juice may be got rid of by adding proteid.

W. D. H.

**The Behaviour of Stereo-isomerides in the Animal Body. I. The Fate of the Three Arabinoses in the Rabbit.** By CARL NEUBERG and JULIUS WOHLGEMUTH (*Zeit. physiol. Chem.*, 1902, 35, 41—69).—In rabbits on an ordinary diet, 14·5 per cent. of *l*-arabinose given by the mouth reappeared in the urine; the corresponding number for *d*-arabinose was 39·07; if *r*-arabinose is given, 21·5 per cent. reappears as *r*-arabinose, and 9 per cent. as *d*-arabinose. In rabbits on a diet free from carbohydrates, the numbers are as follows: 14·55 for *l*-arabinose, 31·18 for *d*-arabinose; in the case of *r*-arabinose, 23·5 per cent. reappeared as such, and 5 per cent. as *d*-arabinose. Very similar numbers were obtained if the arabinoses were given subcutaneously; if given intravenously, the numbers are 28·6 for *l*-arabinose, 29·4 for *d*-arabinose; in the case of *r*-arabinose, 18·2 per cent. reappeared as such, and 5·4 as *d*-arabinose; *d*-arabinose leads to no glycogen formation, *r*-arabinose to the formation of small quantities only.

Further experiments were made with arabonates. If sodium *l*-arabonate is given subcutaneously, a certain quantity (not estimated) of *l*-arabonic acid appears in the urine. If sodium *d*-arabonate is given, less of the *d*-acid appears in the urine. In experiments with the alcohols, it was only after *d*- and *r*-arabitol that small quantities of pentose were found in the urine.

A distinction is drawn between rabbits, which are herbivorous, and man. In herbivora, pentosans form part of the normal diet; in man, this is not the case, and his system is fitted to deal more especially with hexoses and their polysaccharides. In herbivora, there appear to be cytases to deal with pentosans. Of the pentoses, *l*-arabinose, the commonest one in herbivorous diet, is most utilised. The close similarity of the formula of *l*-arabinose to that of dextrose is pointed out. One experiment only on man is recorded, which illustrates the change of the racemic pentose into the optically active variety; *r*-arabinose was given by the mouth; 62 per cent. of the excreted arabinose was of the *d*-variety.

W. D. H.

**Does the Pancreas contain an Enzyme which resolves Dextrose into Alcohol and Carbon Dioxide?** By MAXIMILIAN HERZOG (*Beitr. chem. Physiol. Path.*, 1902, 2, 102—124).—This question, which is important in relation to the existence and nature of the glycolytic enzyme, is answered in the negative.

W. D. H.

**Pancreatic Diastase and its Zymogen.** By HORACE M. VERNON (*J. Physiol.*, 1902, 28, 137—155).—Extracts of pancreas made with various media increase in diastatic activity for some days if left in contact with the tissue. This is considered to be due to the gradual conversion of zymogen into enzyme. On keeping, the extracts became acid, especially at a warm temperature, and their diastatic power deteriorated.

W. D. H.

**Absorption of the Nitrogen from Oatmeal in the Dog.** By DIARMID NOËL PATON (*J. Physiol.*, 1902, 28, 119—121).—The amount of proteid not absorbed from oatmeal by the dog is very considerable; it leaves the body by the fæces.

W. D. H.

**Subcutaneous Injections of Dextrose, and Metabolism.** By JAMES SCOTT (*J. Physiol.*, 1902, 28, 107—118).—Injection subcutaneously of 5 to 7 grams of dextrose per kilo. of body weight in dogs causes a marked increase of proteid metabolism. There is a diminution in the proportion of nitrogen which leaves the body as urea. Diphtheria toxin and sulphonal produce similar effects. W. D. H.

**Rôle of Carbohydrates in the Utilisation of Insoluble Salts by the Organism.** By L. VAUDIN (*Ann. Inst. Pasteur*, 1902, 16, 85—93).—When carbohydrates enter into solution, more mineral matter is also dissolved. Thus when bread was subjected to salivary digestion, the amount of ash obtained in the digested portion was double that which was obtained in a control specimen containing no saliva. The increased utilisation of inorganic compounds so brought about chiefly affects salts of the alkaline earths. This is important to both animal and vegetable physiology. W. D. H.

**Phosphate Metabolism.** By OTTO FOLIN and PHILIP A. SHAFFER (*Amer. J. Physiol.*, 1902, 7, 135—151).—The amount of phosphates in the urine was estimated daily in an insane patient, in whom normal days alternated with 'bad days.' During the latter periods, the amount of phosphate is increased. The diet was not kept constant, but an attempt was made to control the result by examining the urine of the attendant, who tried to make his diet coincide with the patient's. The increased excretion is explained on the following hypothesis: on every second day, the system or some part of it (presumably the nervous tissues) is unable to assimilate a part of the phosphate absorbed from the alimentary tract; this non-assimilated phosphate is eliminated the same day. On the alternating days, less is eliminated because the tissues are then repairing the loss sustained on the previous days. W. D. H.

**Nitrogenous Katabolism in the Hedgehog.** By JOSEPH NOÉ (*Compt. rend. Soc. Biol.*, 1902, 54, 227—229).—During the period of hibernation in the hedgehog, the total nitrogen excreted sank to about two-thirds of what it was previously; the amount of urea was lessened by one-half. In spite of the low temperature of the animal, it was not so deeply asleep as to prevent it being fed with its usual amount of meat. The 'xantho-uric' excretion increased somewhat. This is believed to indicate that imperfect oxidation is the main factor concerned in the production of the effects observed. W. D. H.

**The Fate of Uric Acid, administered as such, in the Human Organism.** By FRANZ SOETBEER and JUSSUF IBRAHIM (*Zeit. physiol. Chem.*, 1902, 35, 1—7).—If uric acid in a soluble form is given by the mouth, the greater part is not absorbed, and no modification is produced in nitrogenous metabolism. But if given subcutaneously (dissolved in piperazine solution), it is eliminated quantitatively as uric acid in the urine; this is contrary to what is generally taught, namely, that uric acid given to mammals is excreted as urea.

W. D. H.

**Synthetical Formation of Uric Acid in the Animal Organism.** By HUGO WIENER (*Beitr. chem. Physiol. Path.*, 1902, 2, 42—85).—It is generally believed that the formation of uric acid in birds is a synthetical one, from urea or ammonia, and some substance like lactic acid which does not contain nitrogen. There is, however, some evidence to show that in these animals the formation of uric acid is to a small extent oxidative from purine derivatives. In mammals, on the other hand, the formation of the acid is mainly oxidative, but again there is evidence that it may be to a small extent synthetical. If this is so, the difference between the two classes of animals is one of degree rather than of kind. The main object of the present paper is to furnish evidence of the synthetical formation of uric acid in mammals. The first experiments were made with "surviving" organs, finely minced, and mixed with physiological salt solution. If the liver so treated is allowed to remain at 40° for some hours, the amount of uric acid originally present is increased, but if it is previously mixed with spleen or thymus similarly treated, the increase is much more marked. If the spleen or thymus is not mixed with liver, there is a less marked increase in them. This is explicable on the hypothesis that the various organs contain forerunners of uric acid, that the spleen and thymus are rich in these, but are able to form uric acid from them in an oxidative manner only, and that the liver is able in addition to synthesise uric acid from precursors other than purine derivatives. This is supported by the fact that the uric acid in the liver is increased by the addition to it of the residue from alcoholic extracts of the spleen and thymus; such extracts are free from nuclein and purine bases. In order to ascertain what substances soluble in alcohol will lead to this result, ammonium sarcolactate and glycine were added to the minced liver, but did not lead to the formation of more uric acid than in the control specimens. Experiments were therefore performed on hens in order to see what substances will in these birds lead to an increase in uric acid formation. If a certain amount of urea is given by the mouth in the diet to these birds, it is practically all accounted for as uric acid in the urine, but if it is administered subcutaneously the rise in uric acid excretion is not marked; evidently some non-nitrogenous substance must be given also. The following were the substances experimented with, glycerol, propionic acid, hydracrylic acid, lactic acid, pyruvic acid, malonic acid, tartronic acid, mesoxalic acid, butyric acid,  $\alpha$ - and  $\beta$ -hydroxybutyric acids, succinic acid, and malic acid. Each of these substances, by itself without urea, produces no increase in uric acid formation; and mere diuretics like sodium chloride or acetate lead also to a negative result, even if urea is given as well. In each subsequent experiment, 3 grams of urea were given subcutaneously, and the other substance by the mouth; the amount of increased uric acid formed was compared with that theoretically to be expected. In the case of hydracrylic acid, malonic acid, tartronic acid, and mesoxalic acid, the amount formed was the same, or approximately so, as the amount expected; in the case of glycerol, lactic acid (of both kinds), pyruvic acid, glyceric acid, and  $\beta$ -hydroxybutyric acid, the amount of increase varied from 17 to 45 per cent. of that expected; all the other substances mentioned gave a negative result. In other



words, all the substances with a chain of 3 carbon atoms, except propionic acid, were active, and all those with a chain of 4 carbon atoms, except  $\beta$ -hydroxybutyric acid, were inactive in this respect. The relations of the formulæ of the various substances to that of uric acid is pointed out. The ureides of some of these substances, like dialuric acid (tartronylurea) have the same effect. So also have the ordinary articles of diet, such as dextrose, albumin (probably through amino-acids), and fat (probably through its glycerol).

The next question was to apply the knowledge so obtained to mammals. In a dog, if nuclein-free and purine-free food is given, the uric acid excretion sinks to a minimum; it increases somewhat, but not markedly, on the administration of sodium malonate, and also of glycerol. In man, it was found that dialuric acid and sodium malonate have a similar slight effect. Some of the substances in the previous list were not, however, tried; sodium acetate has no such effect. With the isolated minced liver, the following substances were tried: sodium malonate, sodium and ammonium barbiturates, tartronates and dialurates, and glycerol, in conjunction with urea. Positive results were obtained only with tartronic and dialuric acids, and this occurred whether the sodium or ammonium salts were employed; they even produced some increase when urea was not mixed with them. The increase is in no case so great as would theoretically be expected; nevertheless the experiments prove that to some extent the mammalian liver possesses the power of synthesising uric acid from urea and certain non-nitrogenous substances.

W. D. H.

**Correlated Production of Indoxyl and Urea in the Organism.** By JULIUS GNEZDA (*Compt. rend.*, 1902, 134, 485—487).—An examination of the urine of patients suffering from measles, scarlatina, and mental disease showed that the amount of indoxyl excreted is directly proportional to the quantity of urea eliminated, the ratio of these products being approximately 1 mol. of indoxyl to 6 mols. of urea. The indoxyl was estimated in the form of indigo, whilst the urea was determined by the Mörner-Sjöqvist and Kjeldahl processes.

These results indicate that the indoxyl found in the urine is not wholly derived from the putrefactive fermentation occurring in the intestine, but that it is more probably produced by the oxidation of a mol. of proteid substance, this reaction being accompanied by the formation of a definite amount of urea.

G. T. M.

**Condition of the Iron in the Spleen.** By WILLIAM BRODIE BRODIE (*Proc. Roy. Soc. Edin.*, 1902, 24, 21—25).—By micro-chemical methods, iron was shown to exist in the spleen in both intra- and extra-cellular positions. The various proteids obtainable from the spleen were isolated, and each was found to contain iron in the ash.

W. D. H.

**Muscle-plasma in different Classes of the Animal Kingdom.** By HANS PRZIBRAM (*Beitr. chem. Physiol. Path.*, 1902, 2, 143—147).—From the examination of the muscles of thirty animals, 15 invertebrate, 15 vertebrate, the following general conclusions are drawn.

Paramyosinogen (Fürth's myosin) is found in all classes. Myosinogen (Fürth's myogen) is found only in vertebrates; in the cyclostomata, however, this gives no precipitate with sodium salicylate; in other vertebrate classes it does. Soluble myogen fibrin is found immediately after death, and therefore probably during life in fishes and amphibians, but in the remaining classes of vertebrates only in the process of *rigor mortis*. Fürth's myoproteid is found in fishes (selachians, teleosteans) in large quantities, and in the merest traces in amphibians; it is absent in reptiles, birds, and mammals. W. D. H.

**Proteids of Smooth Muscle.** By SWALE VINCENT (*Zeit. physiol. Chem.*, 1902, 34, 417—429).—The two principal proteids (paramyosinogen and myosinogen) which are found in saline extracts of muscle, are believed to be present in the muscle itself as a proteid coagulable at 47°. Nucleo-proteid is also present; this, however, requires weak alkali to extract it from the muscle. Smooth muscle contains 6 to 8 times the amount of nucleo-proteid contained in voluntary muscle; cardiac muscle contains an intermediate quantity. Unstriated, like striped, muscle gives a salted plasma which coagulates spontaneously, or by dilution; the coagulum consists of the somewhat altered globulin (paramyosinogen) but the other proteid here spoken of as albumin (myosinogen) takes some part in the formation of the clot. The muscle serum contains only such proteids as are derived from the adherent blood, lymph, and connective tissue. W. D. H.

**Effects of Various Solutions on Ciliary and Muscular Movement in the Larvæ of Arenicola and Polygordius.** By RALPH S. LILLIE (*Amer. J. Physiol.*, 1902, 7, 25—55).—Each of the chlorides of sodium, magnesium, calcium, and potassium exercises a specific influence on contractile tissues, which is evident even in the presence of other salts. Each probably forms a salt-proteid compound (ion-proteid) possessing definite physical properties. For normal activity these must be present in certain definite proportions. These compounds are dissociable, and one salt can be replaced by another. Hence, for instance, the loss of irritability in solutions containing too few sodium ions, and the revival which occurs on subsequent transference to pure solutions of sodium chloride or sea water. Potassium salts are most injurious, because their combinations are not readily dissociable. In solutions of non-electrolytes, the active properties of the tissues are gradually lost; the addition of small quantities of isotonic salt solutions to the non-conductor prevents the immediate loss of the properties which are favoured by the presence of these salts. Development may proceed in favourable artificial mixtures of chlorides of sodium, magnesium, and calcium; it is hindered by the presence of a trace of acid, and furthered by the presence of a trace of alkali. W. D. H.

**Effects of Solutions of Various Electrolytes and Non-conductors on Rigor Mortis and Heat Rigor.** By ANNE MOORE (*Amer. J. Physiol.*, 1902, 7, 1—24).—The two proteids in muscle which are capable of coagulation are paramyosinogen and myosinogen.

Hypotonic solutions, and solutions in which much water is absorbed, lower the temperature of coagulation and shorten the time of completion of *rigor*. Acids raise the temperature of opalescence and lower that of coagulation, the amount of lowering increasing with the degree of dissociation. Alkalis have the opposite effect. The effect of various solutions of salts is also described. Calcium does not appear to be essential for the coagulation of the muscle proteids, unless the small amount present in the tissue itself is sufficient, for coagulation takes place in solutions of salts which precipitate calcium, and also in non-conductors. Although the entrance of water favours coagulation, coagulation phenomena cannot be explained entirely on the basis of osmosis. The nature of the ions is a determining factor. Normal *rigor* is not comparable to ordinary contraction, for heat *rigor* may be added algebraically to contraction, and *rigor* is not reversible. Heat *rigor* is not essentially different from normal *rigor*. Normal *rigor* is probably due to the lowering of the temperature of coagulation of muscle proteids caused by acid, water, or certain salts. W. D. H.

**Biltong.** By WILLIAM D. HALLIBURTON (*Brit. Med. J.*, 1902, i, 880—882).—Samples of biltong had the following percentage composition :

Water .....	19·410
Solids .....	80·590
Inorganic solids .....	6·592
Organic solids.....	73·998
Proteids .....	65·866
Fat (ether extract).....	5·140
Glycogen.....	0·133
Sugar .....	0·090
Extractives (by difference) .....	2·769

Biltong is readily digestible in artificial digestive juices, although not quite so readily as fibrin and rabbit's muscle dried at 30°. The tropical sun has possibly some slight coagulating action on the proteid.

W. D. H.

**Cyclic Terpenes and Camphor in the Animal System.**  
 II. By EMIL FROMM and PAUL CLEMENS (*Zeit. physiol. Chem.*, 1902, 34, 385—392. Compare Fromm and Hildebrandt, this vol., ii, 159; Bonani, *ibid.*, ii, 160).—The behaviour of menthol and borneol in the animal system falls under the generalisation previously given. The mentholglycuronic acid was purified in the form of its *barium* salt, which is, however, too hygroscopic for analysis. The *cadmium* salt,  $C_{32}H_{51}O_{14}Cd, 3H_2O$ , crystallises in small, colourless needles, loses  $1H_2O$  at 100° and becomes anhydrous at 120°. The free *acid* obtained when the cadmium salt is warmed for a short time with dilute sulphuric acid and then extracted with ether, crystallises from water, melts at 87—88°, and contains  $1\frac{1}{2}H_2O$ . When boiled for some time with 10 per cent. sulphuric acid, it is hydrolysed.

Borneolglycuronic acid,  $C_{16}H_{26}O_7$ , melts at 174—175°, and the zinc salt crystallises with  $2H_2O$ . J. J. S.

**Autolysis in Malignant Tumours.** By EUGEN PETRY (*Beitr. chem. Physiol. Path.*, 1902, 2, 94—101).—Carcinomatous tissue (mainly from the breast) if kept at the ordinary temperature (and putrefaction prevented) undergoes autolysis, and among the products, leucine, tyrosine, lysine, and hypoxanthine were identified. Autodigestion is more vigorous than in the normal mammary tissue. The question whether this is a factor to be reckoned with during life was answered in the negative by investigating the newly-removed cancer, and by examining the blood of the patients. Products of proteolysis were not found in the fresh tissue or in the blood.

Injections of extracts of fresh cancer, and of cancerous tissue which had undergone autolysis were made into dogs, and their nitrogenous metabolism examined, but practically no change was found. A hæmolyisin, which has been described as being produced by such tissues during life, was not discovered in the extract used. W. D. H.

**Proteid Decomposition Products in a Degenerated Liver.** By ALONZO ENGLEBERT TAYLOR (*Zeit. physiol. Chem.*, 1902, 34, 580—584).—Acute yellow atrophy of the liver is a disease the cause of which is unknown, and is accompanied by the passage of leucine and tyrosine into the urine. After death, but little of the natural liver substance is discoverable. The liver from a case of this disease was removed 6 hours after death; it weighed 900 grams. It was preserved in alcohol for 3 days, then extracted with ether. The residue from the alcoholic and ethereal extract was freed from fat by treatment with light petroleum, and then extracted with hot water, these extracts were mixed with hot aqueous (neutral and acid) extracts made from the pieces of liver which had been freed from fat by alcohol and ether. It gave no proteid reactions; hexon bases, glutamic acid, and phenylalanine were absent. 0.35 gram of leucine and 0.61 gram of aspartic acid were separated. W. D. H.

**Fat-transference in Phosphorus Poisoning.** By FR. KRAUS and A. SOMMER (*Beitr. chem. Physiol. Path.*, 1902, 2, 86—93).—The relationship of the liver-fat to that of the body has been examined previously in frogs; the present experiments were made on mice. In normal mice, the percentage of fat in the body varied from 14 to 29; the weight of the liver was about 1 gram, and the percentage of fat in it varied from 5 to 12; about 2 per cent. of the total fat in the body was contained in the liver. In mice poisoned by phosphorus, the total weight of the animal was much less, the percentage of fat in the body varied from 4 to 7, the weight of the liver had increased to 1.3—2.2 grams, the percentage of fat in it varied from 7 to 37, and from 20 to 44 per cent. of the total fat of the body was contained in the liver. The observations are considered to show that the chief source of the liver fat is transfer of fat from other parts; it is, however, not absolutely unchanged, for the iodine number of liver fat is higher than that of subcutaneous fat. W. D. H.

**The Poison of the Garden Spider (*Epiria Diadema*).** By HANS SACHS (*Beitr. chem. Physiol. Path.*, 1902, 2, 125—133).—This



poison, named *arachnolysin*, is a hæmolysin, and is identical with what was called toxalbumin by Kobert. Various points in connection with this substance, among which the most important is the production of an antitoxin, have been worked out on the lines of Ehrlich's investigations.

W. D. H.

**Physiological Effects of the Poison ("Hypnotoxin") of the Tentacles of Cœlenterata.** By P. PORTIER and CHARLES RICHEL (*Compt. rend.*, 1902, 134, 247—248).—Two grams of the fresh filaments sufficed to kill a pigeon weighing 300 grams. The substance does not cause pain, but produces a state of torpor which can only be overcome temporarily and with considerable difficulty. The action of the heart is accelerated. The temperature is lowered by 2—5° and there is generally diarrhœa.

Similar results were obtained with ducks and frogs, and with several groups of *Cœlenterata*.

N. H. J. M.

## Chemistry of Vegetable Physiology and Agriculture.

**Effects of the Association of Amylomyces and a Micrococcus.** By PAUL VUILLEMIN (*Compt. rend.*, 1902, 134, 366—368).—In cultivations of *Mucor Rouxianus* and a micrococcus on potatoes, the bacterium developed at the expense of sugar produced by the fungus from starch. A large amount of a yellowish-orange pigment is formed by *Mucor* due to the consumption of maltose by the micrococcus.

N. H. J. M.

**Quantitative Decomposition of Milk Sugar by Bacillus Acidi Lactici.** By PAUL HAACKE (*Arch. Hygiene*, 1902, 42, 16—47).—The products of decomposition of milk sugar by *Bacillus acidi lactici* are lactic acid, acetic acid, and alcohol, together with a gas which was not analysed. The amount of lactic acid obtained never exceeds one-third of the sugar decomposed, and the amount of it present at any moment is not strictly proportional to the sugar decomposed, a portion of the acid being probably further acted on. The amount of sugar decomposed per hour by 1000 bacilli varies according to the conditions from 0.008 to 0.00001 mg.

A. H.

**Study of Lactic Fermentation by Observations of Electrical Resistance.** By PIERRE LESAGE and DONGIER (*Compt. rend.*, 1902, 134, 612—614).—The specific resistance of fresh milk from various cows varies between 230 and 275 ohms and for the same cow varies from 245 to 265 ohms. When the milk is kept, the resistance rapidly diminishes until after about 4 days the milk coagulates, the resistance at this point varying from 185 to 175 ohms whatever the original resistance of the milk. After coagulation, the change in resistance

becomes very slow. The changes are more rapid in open than in closed vessels. The resistance of the whey is about 158 ohms, but this gradually diminishes, especially in open vessels. C. H. B.

**Assimilation of Nitrogen by Plants.** By O. BREFELD (*Chem. Centr.*, 1902, i, 434—435; from *Jahresber. Schles. Ges. vaterl. Kult. Sitz. zool.-bot. Sekt.*, 1901, and *Centr. Bakt. Par.*, 1902, ii, 8, 24—25).—Experiments in sterilised sand with gramineous plants and *Ustilagineae* *Panicum miliaceum* with *Ustilago destruens*, *Sorghum saccharatum* with *Ustilago sorghi*, and *Setaria italica* with *Ustilago setariae* with mineral manure, with and without nitrogen, showed that no assimilation of free nitrogen took place. N. H. J. M.

**Alinit.** By CARL SCHULZE (*Bied. Centr.*, 1902, 31, 145—147; from *Landw. Jahrb.*, 1900, 30, 319).—The alinit bacillus failed to grow in non-nitrogenous solutions and seems to require organic nitrogenous matter.

Pot experiments were made in which wheat was grown in a mixture of Ellenbach soil with ground sandstone and in sandstone with dextrose. There were three sets of pots (a) sterilised and inoculated with a pure cultivation of the alinit bacteria, (b) sterilised, and (c) not sterilised and not inoculated. It was found at the conclusion of the experiment that moulds were present in nearly all the pots and that the soil contained several foreign bacteria; the alinit bacterium, however, predominated in every case. There was no fixation of free nitrogen, but a distinct loss of nitrogen. A second set of experiments was made to ascertain the effect of carbohydrates. The results were again negative.

Similar results were obtained in pots which were exposed to air.

Field experiments with barley and oats gave negative results.

N. H. J. M.

**Separation of Galactose from Dextrose by Saccharomyces Ludwigii.** By PIERRE THOMAS (*Compt. rend.*, 1902, 134, 610—612).—If lactose inverted by means of sulphuric acid is mixed with *Saccharomyces Ludwigii* cultivated in a nutritive liquid containing 5 to 6 per cent. of sucrose and is kept at 25°, all but a minute quantity of the dextrose is decomposed whilst the galactose is practically unaltered. The nitrogenous matter may be precipitated by means of alcohol and the galactose crystallised. It can be purified by repeating the treatment with the yeast. It is important to cultivate the *Saccharomyces Ludwigii* in a liquid containing sucrose, otherwise part of the galactose will be attacked. C. H. B.

**Function of Peroxides in Cell-life. I.** By ROBERT CHODAT and A. BACH (*Ber.*, 1902, 35, 1275—1279).—*Penicillium glaucum*, *Rhizopus nigricans*, and *Sterigmatocystis nigra* are able to flourish in solutions containing 1 per cent. of hydrogen peroxide. The peroxide is not therefore a specific poison, and may play a regular part in cell-life.

T. M. L.

**Respiration of Plants.** By A. FLIOROW (*Bied. Centr.*, 1902, 31, 180; from *Bot. Centr.*, 1901, 87, 274).—In experiments with *Mucor*

*mucedo* it was found that the concentration of the organic food affects the amount of dry matter produced. The food values of the different substances employed decrease in the following order: *lævulose*, *dextrose*, *maltose*, *saccharose*, *inulin*, *ammonium tartrate*, and *tartaric acid*. Removal from the nutritive solution at once greatly reduces the respiration in the case of *Mucor*, as it has no reserve, but has very little immediate effect on *Psalliota campestris*.

In absence of food, *Amanita muscaria* undergoes a loss of non-nitrogenous matter. There is a production of proteid and nuclein during the period between formation and ripening of spores, followed by a rapid loss of proteids.

N. H. J. M.

**Respiration of Plants.** By K. PURJEWICZ (*Bied. Centr.*, 1902, 31, 180—181; from *Bot. Centr.*, 1901, 87, 141).—The respiration quotient increases with the relative amount of oxygen in the food. In the case of carbohydrates, it is generally smaller the greater the mol. weight. With dextrose and sucrose, the quotient increases with the strength of the solutions until a maximum (10 per cent.) is reached, after which it diminishes.

Dextrose, glycerol, mannitol, and lactic acid yield relatively less carbon dioxide in "physiological combustion" than in "chemical combustion." In the case of tartaric acid, the relations are reversed.

In absence of food, the amounts both of carbon dioxide produced and of oxygen absorbed are reduced, but the greater difference is in the case of the carbon dioxide.

N. H. J. M.

**Assimilation of some Fungi compared with that of Green Plants.** By THOMAS BOKORNY (*Pflüger's Archiv*, 1902, 89, 454—474).—The assimilation energy, measured by the relative increase in weight per unit of time, is much greater for moulds and yeasts than for green plants. Thus a mould nourished with glycerol and ammonium sulphate increased in weight 1000 times during 28 days. Yeast yields the largest crop in presence of cane sugar when its nitrogenous nourishment is peptone, asparagine being less favourable, and ammonium sulphate least of all. 0.31 gram of dry yeast increased in two days to 0.88 gram in presence of cane sugar and peptone, and to 0.8 gram in presence of peptone without sugar but in a solution which was continually aerated.

The green alga, *Spirogyra*, is capable of obtaining its carbon from sodium formaldehydesulphonate in the absence of carbon dioxide, starch being formed in the cells. Under these conditions, 0.07 gram of the dried alga gave about 0.11 gram in 5 days.

A. H.

**Assimilation of Sugar and Alcohol by Eurotopsis Gayoni.** By PIERRE MAZÉ (*Compt. rend.*, 1902, 134, 191—193. Compare *Abstr.*, 1899, ii, 607).—The results of experiments in which *Eurotopsis Gayoni* was grown on Raulin solutions containing invert sugar and ethyl alcohol respectively, indicated that in the case of sugar the fungus grows at the expense of the alcohol produced from it. Both the carbon dioxide produced and the oxygen consumed were determined.

The composition of the growth obtained in both cases was similar except as regards percentage of nitrogen, which was rather higher in the fungus grown with alcohol. The composition of the fungus corresponds with that of a substance produced by the union of acetaldehyde (43 mols.) and ammonia (8 mols.). N. H. J. M.

**Assimilation of Lactic Acid and Glycerol by *Eurotopsis Gayoni*.** By PIERRE MAZÉ (*Compt. rend.*, 1902, 134, 240—242).—*Eurotopsis Gayoni* consumes more lactic acid than glycerol in producing the same weight of substance. In lactic acid solutions, alcohol and carbon dioxide are produced, as well as appreciable amounts of acetaldehyde. The conclusion may be drawn that the plant only utilises the alcohol (after oxidation to acetaldehyde) formed from lactic acid.

In the case of glycerol, more oxygen is consumed than with lactic acid. The hydrogen eliminated from the glycerol is completely oxidised.

The composition of the fungus was the same in both experiments.

N. H. J. M.

**Relations of Calcium and Magnesium to the Growth of Plants.** By W. MAY (*Chem. Centr.*, 1902, i, 365; from *U.S. Dept. Agr. Bul.*, 1901, No. 1, 37—53).—Experiments were made in which various plants were grown in water, sand, and soil, and manured with calcium and magnesium as sulphates, nitrates, and carbonates. A great excess of magnesium was found to be very injurious, and excessive amounts of calcium check the growth. The best relations of calcium to magnesium are 7 : 4.

Calcium should be applied in conjunction with manures which contain much magnesium, or when the soil contains more magnesium than calcium.

N. H. J. M.

**Chemical Modifications in Plants under the Influence of Sodium Chloride.** By EUGENE CHARABOT and ALEXANDRE HÉBERT (*Compt. rend.*, 1902, 134, 181—184. Compare *ibid.*, 132, 159).—The effect of watering peppermint plants with 2.5 per cent. sodium chloride solution was to diminish the percentage loss of water and increase the gain in organic matter more than when no sodium chloride was applied. The essential oil produced in the plants treated with sodium chloride contained more ethers and less menthone than without sodium chloride.

N. H. J. M.

**Supposed New Substances: Pagliari's Olivin and Olivoin.** By P. SPICA (*Gazzetta*, 1902, 34, i, 186—187).—These two substances, obtained by Pagliari (*Movimento farmaceutico*, 1901, Nov., 1—15) from the leaves of the olive, are respectively calcium sulphate and magnesium sulphate.

T. H. P.

**Transformation of Fatty Substances into Sugar in Germinating Oleaginous Seeds.** By PIERRE MAZÉ (*Compt. rend.*, 1902, 134, 309—311).—The results of experiments with earth-nut showed that



a progressive fixation of oxygen took place, with probably a slight loss of carbon, and that sugar is produced from the fat.

N. H. J. M.

**Sugars and Organic Acids contained in some South European Fruits.** By ARTHUR BORNTAEGER (*Zeit. Nahr.-Genussm.*, 1902, 5, 145—155).—The invert (reducing) sugar, the sucrose, and acidity have been estimated in the following fruits:—*Diospyros Lotus*, (Oriental date plum), *Diospyros virginiana* (Virginian date plum), *Diospyros Kaki* (date fig), *Sorbus domestica*, *Mespilus germanica* (medlar), *Arbutus Unedo*, *Musa sapientum* (banana), and *Eryobotrya japonica* (Japanese medlar). All these fruits contained invert sugar varying in the ripe fruits from 4.71 to 16.2 per cent. Sucrose was found only in the unripe fruit of *Arbutus Unedo* (7.34 per cent.), in ripe *Musa sapientum* (7.24 per cent.), and in both the ripe and unripe fruit of *Eryobotrya japonica* (from 2.47 to 4.94 per cent.). The fruits all contained malic acid, but other organic acids, such as oxalic, tartaric, racemic, and citric acid, could not be detected, except in the case of *Eryobotrya japonica*, the juice from the unripe fruit of which contained on the average 1.24 per cent. of citric acid. Tannin was present in *Diospyros Kaki* and *Diospyros Lotus*.

W. P. S.

**Occurrence of Tannin, Starch, and Sugar in First-year Plants of *Acer Pseudoplatanus*.** By J. HÄMMERLE (*Chem. Centr.*, 1902, i, 597; from *Ber. bot. Ges.*, 19, 538—551).—In continuation of previous work by the author and by Berthold, the various parts of the young plants of *Acer Pseudoplatanus* have been tested for the presence of tannin, starch, and sugar from time to time during their early growth and the variations in the amounts of these substances qualitatively determined. The details given in the paper have mainly a botanical interest.

E. W. W.

**Quantity of Indican contained in *Indigofera Tinctoria* and the Manufacture of Indigo.** By AUGUST SCHULTE IM HOFE (*Chem. Centr.*, 1902, i, 672; from *Ber. Deut. Pharm. Ges.*, 1902, 12, 19—30).—Experiments have shown that bacteria do not play any essential part in the production of indigo, the formation of the indigo precipitate not being dependent on the action of these organisms. The original paper contains determinations of the quantity of indican contained in *Indigofera tinctoria* at various periods of growth. The whole of the indican may be extracted from the plant by 2 hours' digestion at 53°, this substance not being decomposed at that temperature. The indican cannot be dissolved from the living plant by water until fermentation has set in, whereby an acid is liberated and the plants are more rapidly killed. As soon as the whole of the oxygen dissolved in the water has been used, the acid fermentation which does not attack the indican gives place to a reducing fermentation by which indican is decomposed and indigo consequently lost. The yield of indigo may be increased by the addition of alkali; the alkali precipitates compounds which dissolve in sulphuric acid, forming red solutions.

E. W. W.

**Conditions of Proteid Formation in Plants.** By W. ZALEWSKI (*Bied. Centr.*, 1902, 31, 166—172; from *Bot. Centr.*, 1901, 87, 277. Compare Abstr., 1901, ii, 619).—In addition to the results obtained with *Allium Cepa* and onions (*loc. cit.*), results obtained with potatoes are described. Tubers when kept in the dark showed little variation in the amount of proteid (percentage of total nitrogen) and the asparagine nitrogen remained very constant.

Decomposition of proteids in seedlings was checked by the presence of ether. In presence of dextrose, decomposition of proteids was greater than production, whilst caffeine increased decomposition.

Leaves of *Helianthus annuus* produced proteids in absence of light from solutions containing nitrates and sugar. N. H. J. M.

**Chemical Composition of *Fragaria Vesca*.** By GIULIO PARIS (*Chem. Zeit.*, 1902, 26, 248—249).—Analyses have been made of the juice of strawberries (*Fragaria vesca*) and the following results obtained :

	I.	II.	III.
Total extract.....	6.56	6.75	7.04
Ash .....	0.65	0.66	0.69
Total acid .....	1.28	1.44	1.36
Citric acid .....	1.17	1.22	—
Malic acid .....	0.14	0.19	—
Reducing sugar.....	3.04	1.28	3.00
Sucrose .....	0.34	1.23	0.51

Analyses I and III were made with scarcely ripe fruit juice, II with juice from quite unripe fruit. No oxalic, tartaric, salicylic, or benzoic acid could be found. J. McC.

**Value of Condiments in the Feeding of Bullocks.** By JOHN A. VOELCKER (*J. Roy. Agr. Soc. Eng.*, 1901, 62, 299—307).—The results of experiments in which bullocks were fed with cake, swedes, oat straw, chaff, and hay, and with the same ration partially replaced by locust bean meal, spice, and cane sugar molasses respectively were, on the whole, not favourable to the use of condiments. Of the three condiments, molasses proved to be the best, but the quantity should not exceed  $\frac{1}{4}$  lb. per head per day. N. H. J. M.

**Alcohol in Milk.** By KURT TEICHERT (*Bied. Centr.*, 1902, 31, 210; from *Landw. Centr. Prov. Posen*, 1901, 234).—Milk from cows fed with slump (90), rye bran (2), linseed cake (1 lb. per day), in addition to oat and rye straw chaff, was found to contain fusel oil. Calves fed with the milk died.

The injury to the milk was shown, by further experiments with cows and sheep, to be due to the slump, which was strongly acid, and yielded 0.9 per cent. of acetic acid when distilled. N. H. J. M.

**Amount of Volatile Fatty Acids in Butter Fat.** By PAUL VIETH (*Bied. Centr.*, 1902, 31, 125—127; from *Milchzeit.*, 1901, 177).—The results of determinations in the milk of four Hanoverian dairies showed that, in the autumn, the Reichert-Meissl number fell to below 25 in

each case, to below 24 in three out of the four, and to below 23 in the case of two dairies (East Friesland).

The highest percentage of volatile fatty acids occurs in the spring, and the amounts decrease to a minimum in October and November. The variations depend partly on the feeding and partly on the period of lactation, the Reichert-Meissl numbers falling as the period of lactation proceeds.

N. H. J. M.

**Soaking of Seed Wheat and Seed Barley in Solutions of Sodium Iodide, Bromide, and Chloride.** By JOHN A. VOELCKER (*J. Roy. Agr. Soc. Eng.*, 1901, 62, 326—329).—Solutions containing 1, 10, and 20 per cent. of each salt were employed. The 1 per cent. solutions somewhat benefited wheat; the 20 per cent. solutions and the 10 per cent. iodide solution were injurious. In the case of barley, no beneficial effect was observed after soaking in the 1 per cent. solutions of sodium iodide and bromide and the stronger solutions of the same salts were only slightly injurious. Sodium chloride was, however, distinctly injurious to barley.

N. H. J. M.

**Influence of Lithium Chloride on Wheat and Barley.** By JOHN A. VOELCKER (*J. Roy. Agr. Soc. Eng.*, 1901, 62, 318—326. Compare Abstr., 1901, ii, 269).—In the case of wheat, application of lithium chloride (at the rate of 0.5 to 2 cwt. per acre) retarded germination and produced shorter and weaker straw; it also reduced the yield of grain. The effect on barley was to retard growth and to reduce the production of grain; barley straw was not, however, shortened by lithium chloride.

N. H. J. M.

**Hard and Soft Wheat.** By JOHN A. VOELCKER (*J. Roy. Agr. Soc. Eng.*, 1901, 62, 332—334).—The production of hard and soft wheat was found to depend on the nature of the soil rather than on the character of the wheat sown (compare Abstr., 1901, ii, 270).

N. H. J. M.

**Manurial Experiments with Hops.** By THEODOR REMY (*Bied. Centr.*, 1902, 31, 82—87; *from Blätt, Gersten-, Hopfen-, u-Kartoffelbau*, 1900, 136).—Kainite increased the yield of hops in seven experiments out of nine; in one case, the yield was diminished. The same amount of potassium, in the form of 48 per cent. potassium sulphate, gave in every case an increased yield, and the increase was greater than with kainite. When the amount of potassium sulphate was doubled, the increase was still greater. Potassium sulphate produced hops of better quantity than kainite in nearly every case.

The results of subsequent experiments showed that nitrogenous manure applied to good and inferior soils was favourable as regards yield but less favourable to quality. Phosphoric acid had much less effect.

N. H. J. M.

**Edible Fungi.** By ALEXANDER ZEGA (*Chem. Zeit.*, 1902, 26, 10).—Analyses of the following fungi, obtained in the Belgrade market, are given: *Agaricus esculentus* (1 and 2); *Agaricus arvensis* (3 and 4); *Lactarius piperatus* (5—8); *Coprinus comatus* (9):

*Percentage Composition.*

	Weight. (grams)	Water.	Nitrogenous matter.	Fat.	Non-nitrog. extract.	Crude fibre.	Ash.
1.	46	93.41	1.73	0.12	3.54	0.39	0.81
2.	18	94.02	1.69	0.08	3.04	0.41	0.76
3.	102	90.01	6.72	0.18	1.56	0.78	0.75
4.	96	89.12	6.64	0.15	2.62	0.84	0.63
5.	16	84.52	6.86	0.92	3.09	3.62	1.09
6.	12	83.84	7.21	1.12	3.68	3.20	0.95
7.	50	87.26	5.73	1.06	1.88	3.06	1.01
8.	70	86.98	5.96	1.20	1.63	3.34	0.89
9.	78	94.31	2.01	0.09	2.95	0.15	0.49

The fat of *Lactarius piperatus* is a white, crystalline substance, which melts at 67.5° and solidifies at 63°.

N. H. J. M.

**Experiments on Potatoes.** By MAX FISCHER (*Bied. Centr.*, 1902, 31, 116—119; from *Fühling's Landw. Zeit.*, 1901, 337 and 361).—Under ordinary conditions, with the most remunerative amounts of manures, potatoes of the largest size should be exclusively used as seed potatoes. When manure is deficient or excessive in quantity, or when the soil is rich, small potatoes may be employed, but on rich soil it is preferable to sow selected large potatoes.

N. H. J. M.

**Experiments on Weed Prevention.** By JOHN A. VOELCKER (*J. Roy. Agr. Soc. Eng.*, 1901, 62, 334—341).—The application of copper sulphate to the under side of the leaves destroyed the plants to a very great extent. Treatment with phenol greatly reduced the growth of wild onion without injuring the land; and application of lime in the spring, in conjunction with proper cultivation, was very effective in eradicating the annual chrysanthemum.

N. H. J. M.

**Liming Soils from a Physiological Point of View.** By OSCAR LOEW (*Chem. Centr.*, 1902, i, 365; from *U.S. Dept. Agr. Bul.*, 1901, No. 1, 9—35).—Magnesium in soils is only injurious when in considerable excess in relation to calcium, as after application of crude potassium salts. The injurious effect is readily overcome by liming.

Thom's method for the approximate estimation of calcium and magnesium is recommended (extracting the sifted soil with 10 per cent. hydrogen chloride).

When the application of magnesium seems desirable, finely powdered magnesite, or unburnt, powdered limestone containing magnesium are preferable to precipitated basic magnesium carbonate or burnt magnesia. The latter is too readily assimilated and may be injurious.

N. H. J. M.

**Manurial Experiments with Precipitated Calcium Phosphate.** By HENRIK G. SÖDERBAUM (*Bied. Centr.*, 1902, 31, 203; from *Med. kongl. Landtb.-Akad. Exper. Stockholm*, No. 67, 1—15).—The phosphate (essentially normal tricalcium phosphate) was pre-



pared electrolytically from apatite and contained  $P_2O_5$ , 35.75, and  $CaO$ , 48.83 per cent., together with calcium carbonate and small amounts of calcium fluoride and chloride. Of the total phosphoric acid, 91 per cent. dissolved in 2 per cent. citric acid.

The results of pot experiments with oats showed that notwithstanding the solubility in citric acid, the phosphate did not contain much available phosphoric acid. The same amount of phosphate applied as basic slag and as superphosphate yielded three to four times as much produce as the precipitated phosphate.

N. H. J. M.

**Pot Experiments on the Manurial Value of Various Phosphates.** By OSCAR KELLNER and O. BÖTTCHER (*Chem. Zeit.*, 1902, 26, 8—9).—The phosphates employed were (1) double superphosphate, (2) Chinchas guano, (3) Lobos guano, (4 and 5) Algerian phosphate A and B, (6) crude Indian bone meal, (7) bone meal freed from fat and (8) the same as (7) but more coarsely ground, (9 and 10) fine and coarse steamed bone meal. The manures 1—5 were employed both with and without addition of calcium carbonate. The soil was a humous sand containing only 0.05 per cent. of phosphoric acid and no chalk. The plants (oats) were manured with nitrogen and potassium.

In presence of calcium carbonate, the effect of the phosphatic manures, especially Algerian phosphates and bone meal, was much diminished.

The relative effect of the water-soluble phosphoric acid of the different phosphates was as follows: (1) 100; (2) 46; (3) 35; (4) 39; (5) 35; (6) 55; (7) 52; (8) 31; (9) 51, and (10) 28.

The relations of superphosphate without and with calcium carbonate were 100:89; and of Algerian phosphate B, 35:10.

N. H. J. M.

## Analytical Chemistry.

**The Use of Centrifugal Apparatus for Quantitative Analysis.** By FRITZ STEINITZER (*Zeit. anal. Chem.*, 1902, 41, 100—105).—The precipitates obtained in quantitative analysis can be very rapidly collected and washed by the use of centrifugal apparatus. The vessel employed is a glass tube with a detachable conical bottom of glass, porcelain, or platinum, in which the precipitate collects, and in which it is washed, dried, and weighed. Two to four minutes usually suffice for the collection of the precipitate, and very few washings with small volumes of water are required.

M. J. S.

**Litmus-Silk.** By FRIEDRICH EMICH (*Monatsh.*, 1902, 23, 76—80. Compare this vol., ii, 45).—The blue litmus-silk, previously recommended (*loc. cit.*), is hydrolysed by much water and becomes red. A

blue litmus-silk, stable to water but less delicate, can be prepared by soaking the red litmus-silk in lead acetate solution. The blue litmus-silk thus obtained contains much lead oxide, and is a most delicate test for hydrogen sulphide; by its means, 0.0001 mg. of sodium sulphide can be distinctly recognised.

K. J. P. O.

**Preparation of N/100 Potassium Hydroxide and N/2 Alcoholic Potassium Hydroxide.** By OTTO SCHMATOLLA (*Chem. Centr.*, 1902, i, 333; from *Pharm. Zeit.*, 47, 25).—The author prepares N/100 potassium hydroxide by diluting 50.5–51 c.c. of N/10 solution to 500 c.c. and standardising this with a N/10 or N/100 solution of pure oxalic acid, using iodoeosin as indicator. The water should have been well boiled, and must not become turbid on adding a few drops of basic lead acetate. To prepare the N/2 alcoholic solution, 5–6 grams of fused potassium hydroxide are dissolved in 5 c.c. of water, the solution is diluted with absolute alcohol to nearly 100 c.c., and clarified by agitating with 5 grams of dried sodium sulphate. The clear liquid is then poured off, standardised with N/10 hydrochloric or oxalic acid, and suitably diluted. A slight dilution with water before titration is advisable.

L. DE K.

**Reactions for Ozone.** By CARL ARNOLD and CURT MENTZEL (*Ber.*, 1902, 35, 1324–1330).—The various well-known tests for ozone, namely, zinc iodide or potassium iodide and starch, guaiacum tincture, potassium iodide and an indicator for alkalinity, thallium hydroxide, tetramethyl-*p*-phenylenediamine, the phenylenediamines, and silver foil, are adversely criticised, since they are not sufficiently characteristic and all are disturbed by the presence of chlorine, bromine, nitrous acid, or hydrogen peroxide. The best of these tests consists of a paper impregnated with potassium iodide and phenolphthalein or rosolic acid. The authors recommend test papers impregnated with a saturated alcoholic solution of benzidine or tetramethyldi-*p*-aminophenylmethane. The benzidine papers turn brown with ozone, blue with nitrous fumes, blue and then red-brown with chlorine, and do not react with hydrogen peroxide, hydrogen cyanide, ammonia, hydrogen sulphide, or ammonium sulphide. A benzidine paper impregnated with a dilute copper sulphate solution is turned blue by hydrogen cyanide. An alcoholic solution of benzidine containing also a little copper sulphate gives a blue precipitate with very small traces of hydrogen peroxide.

The test papers of tetramethyldi-*p*-aminophenylmethane are even more delicate than the benzidine papers; with ozone they give a violet coloration, with nitrous fumes a straw-yellow, and with chlorine or bromine a deep blue; they do not react with hydrogen peroxide and the delicacy of the ozone reaction is considerably increased by the presence of free acetic acid.

R. H. P.

**Estimation of Sulphates in Urine.** By OTTO FOLIN (*Amer. J. Physiol.*, 1902, 7, 152–154).—Fifty c.c. of urine are mixed in a small Erlenmeyer flask with 0.2 gram of potassium chlorate and 4 c.c. of hydrochloric acid of sp. gr. 1.2, and boiled for 15–20 minutes. Twenty-

five c.c. of a 6 per cent. solution of barium chloride are then added, the mixture kept hot (not boiling) for 45 minutes, and then filtered. The precipitate is washed with hot water, and a few times with hot 5 per cent. solution of ammonium chloride. The moist filter is transferred to a weighed crucible, and 2 or 3 c.c. of alcohol are poured on it and ignited. This dries the filter and prevents sputtering; incineration is now performed and the amount of  $\text{SO}_3$  found by multiplying the weight of barium sulphate by 0.34293.

W. D. H.

**Gravimetric Estimation of Gaseous Nitrogen.** By ALEXANDER P. LIDOFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 42—51).—The author's method, described in detail in this paper, consists essentially in passing the nitrogenous gas over a mixture of 1 part of powdered magnesium and 3.5—4 parts of freshly ignited lime heated to redness in a bulb tube of hard glass. The magnesium nitride thus obtained is decomposed by water in presence of potassium hydroxide, the ammonia formed being then distilled over into standard sulphuric acid, the excess of which is afterwards determined by titration. A number of measurements show that the method gives results much more accurate than those obtained by the ordinary method of determining nitrogen.

T. H. P.

**Behaviour of Nitric and Nitrous Acids towards a Solution of Brucine in Sulphuric Acid.** By LUDWIG W. WINKLER (*Zeit. angew. Chem.*, 1902, 15, 170—172).—A reply to Lunge (this vol., ii, 288). The author communicates a series of experiments showing that nitrites react quite as energetically as nitrates with brucine if only a moderate amount of free sulphuric acid is used.

L. DE K.

**Estimation of Citrate-insoluble Phosphoric Acid.** By C. D. HARRIS (*J. Amer. Chem. Soc.*, 1902, 24, 25—27).—A criticism of the method until recently in use in the laboratory of the North Carolina Department of Agriculture.

The author uses the following arrangement for collecting the residue insoluble in solution of ammonium citrate of sp. gr. 1.09 at 65°. A carbon filter is taken and in the bottom of it is placed a tightly-fitting perforated porcelain disc to which is attached a small wire extending down beyond the small end of the carbon filter. A rubber stopper is then fitted tightly in a pressure bottle and the carbon filter passed through it. A layer of asbestos is placed on the disc in the carbon filter and pressure is applied.

The insoluble matter after being washed is dissolved in a mixture of two volumes of nitric acid and one volume of hydrochloric acid, and then boiled down to a small volume. After diluting to a definite bulk, an aliquot part of the solution containing about 0.4 gram of the original sample is nearly neutralised with ammonia, 10 or 12 grams of ammonium nitrate are added, and the phosphoric acid precipitated with the usual molybdic solution, the precipitation being accelerated by means of Wagner's shaking apparatus. Antimony rubber stoppers are recommended. Finally, the yellow precipitate is titrated.

L. DE K.

**Detection of Arsenic.** By CARL ARNOLD and CURT MENTZEL (*Chem. Centr.*, 1902, i, 600—601; from *Pharm. Zeit.*, 47, 101).—The process recommended by Seybel and Wikander (this vol., ii, 289) when applied to hydrochloric acid does not answer unless this has a strength of more than 22 per cent.; if less, it will be necessary to add some sulphuric acid.

To detect traces of arsenic in compounds of barium, calcium, strontium, mercury, and antimony compounds, these should be boiled with a solution of sodium carbonate and the filtrate evaporated to a small bulk. This should be free from all compounds which decompose or precipitate potassium iodide.

A few c.c. of the acid to be tested or of the alkaline solution are mixed in a wide test-tube with a few drops of a 50 per cent. solution of potassium iodide, the tube is cooled, and one-third of the volume of sulphuric acid slowly added. A yellow precipitate points to arsenic (formation of arsenic tri-iodide), a yellow or reddish coloration is merely due to free iodine.

L. DE K.

**Selmi's Process for the Toxicological Detection of Arsenic.** By GUIDO GIUDICE (*Gazzetta*, 1902, 34, i, 164—172. Compare Abstr., 1881, 311).—It was found by Ogliastro and Forte (*Rendic. Reale Accad. Sci. fis.-math. Napoli*, Dec. 1896) that if antimony is present in any matter submitted to Selmi's test, this metal passes over as volatile chloride with the arsenic, even when the temperature of the bath is kept at 130°. The author has carried out tests with a liquid containing arsenious acid in the presence of salts of tin, mercury, or antimony. Neither mercury nor tin passes over with the arsenic, whilst for antimony Ogliastro and Forte's result is confirmed, with the addition that the antimony is prevented from passing over by keeping the bath at a temperature of 115°. Weighing the arsenic mirror obtained by Marsh's method is not a satisfactory way of estimating the element.

T. H. P.

**Simple Method for the Estimation of Boric Acid.** By A. HEBERAND (*Zeit. Nahr.-Genussm.*, 1902, 5, 55—58).—The aqueous solution containing the boric acid is made feebly alkaline with sodium hydroxide and evaporated to dryness in a platinum basin. The residue obtained is ignited until all carbonaceous matter has disappeared; it is then dissolved in 5 c.c. of water containing 0.5 c.c. of hydrochloric acid and transferred to a test-tube. The basin is rinsed out with 15 c.c. of alcohol, which are also added to the contents of the test-tube, 15 c.c. of hydrochloric acid of sp. gr. 1.12 are then added, and, after cooling, 0.2 c.c. of a 1 per cent. solution of turmeric. On standing for half-an-hour, should boric acid be present, a coloration is produced, varying in tint from light brown to bright red. The colour thus obtained may be compared with that produced in tubes containing known amounts of boric acid. The presence of 0.1 mg. of the latter gives a feeble brown tint, whilst 10 mg. yield a bright rose red colour. The coloration is somewhat fugitive, and is destroyed by prolonged exposure to light, and also by boiling.

W. P. S.



**Spectroscopic Estimation of Boric Acid, especially in Mineral Waters.** By F. MURARO (*Gazzetta*, 1902, 32, i, 173—178).—The author has investigated the conditions under which Föhr's spectroscopic method (*Zeit. anal. Chem.*, 1887, 26, 79) can be applied to the determination of boric acid in mineral waters. It is found that, before applying this method, the non-alkaline metals must be removed from the solution as also must calcium. The former may be got rid of by the method proposed by Parmentier (*Abstr.*, 1891, 1551), whilst calcium salts may then be precipitated by means of ammoniacal ammonium carbonate, the filtrate being afterwards evaporated to dryness, ignited, and re-dissolved in water. If much magnesium is present, the solution must further be treated with just the amount of potassium carbonate required to precipitate this metal. Where calcium salts are present only in small proportion, whilst the water contains relatively much boric acid, both the magnesium and calcium may be precipitated directly by potassium carbonate.

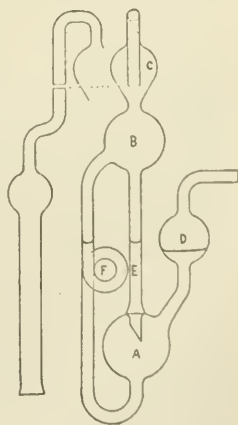
T. H. P.

**Estimation of Carbon in Steel by Direct Combustion.** By RUDOLF L. LEFFLER (*Chem. News*, 1902, 85, 121—122).—The steel borings are sifted, and 2.5 grams of the portion passing a 20-mesh sieve, but retained by a 40-mesh, are mixed with 6 grams of red lead, placed in a porcelain boat, and after drying in a water-bath, are burnt in a porcelain tube, partially filled with copper oxide. The tube is provided with arrangements for purifying the inlet air, and with the usual calcium chloride tube and potash bulbs. A hot furnace is necessary for the combustion. Special steels, such as tungsten steel, do not require sifting.

D. A. L.

**New Design for Potash Bulbs.** By J. N. TERVET (*Chem. News*, 1902, 85, 112—113).—The apparatus consists of two main bulbs, *A*, *B*, and two guard bulbs, *C*, *D*, connected as shown in the figure; the level of the potash when not in use is also indicated. When in use, the gas enters at *D* and forces the potash up *E* into *B*, until the oblique cut at the bottom of *E* is exposed, when the gas bubbles up through *E*, whilst the potash drains from *B* down the syphon tube *F* back into *A*. In this manner, a circulation favourable to the uniform utilisation of the potash and to the thorough washing of the gas is maintained.

D. A. L.



**Estimation of Silicon in High-Grade Ferro-Silicons, by Means of Sodium Dioxide.** By CHARLES RAMORINO (*Chem. Centr.*, 1902, i, 333; from *Mon. Sci.*, [iv], 16, i, 18).—To prevent the violent reaction which takes place when sodium dioxide acts on ferro-silicon, the author operates as follows: 0.5 gram of the powdered sample is mixed with 10 grams of potassium sodium carbonate and 1 gram of

sodium dioxide and slowly heated; the decomposition is complete in a short time. The mass is boiled with water, and a little hydrochloric acid, mixed with 10 c.c. of nitric acid and 2 grams of potassium chlorate, evaporated to dryness and the residue dried at  $110^{\circ}$ . After boiling with 20 c.c. of hydrochloric acid and 200 c.c. of water, the silica is collected, washed, dried, ignited, and weighed. The filtrate may be used for the estimation of sulphur and manganese.

L. DE K.

**Estimation of Alkali Hydroxide or Hydrogen Carbonate in the Presence of Normal Alkali Carbonate.** By BARKER NORTH and W. C. LEE (*J. Soc. Chem. Ind.*, 1902, 21, 322—325).—Thompson's method of estimating alkali hydroxide in the presence of normal carbonate by first titrating with normal acid in the presence of phenolphthalein and then finishing the titration with methyl-orange as indicator, has been criticised by Ridenour (this vol., ii, 49), who uses a certain factor to compensate for what he believes to be a constant error. The authors state that good results may be obtained by working in daylight and immersing the point of the burette in the liquid so as to prevent escape of carbon dioxide in the first stage of the titration. They also found that Robertson's statement as to the influence of large quantities of sodium chloride is correct, but the amount needful to cause error is far above that which is likely to occur in samples of soda ash.

The process as applied to soda ash is briefly as follows: 5 to 10 grams of the sample are dissolved and made up to 250 c.c. Fifty c.c. are then titrated with *N* acid, using phenolphthalein as indicator, and the neutralisation then completed by the aid of methyl-orange. If the amount of acid used in the first stage of the titration exceeds that of the second, the sample contains sodium hydroxide, but if it should be less, this shows the presence of sodium hydrogen carbonate; the difference in acid is then calculated into either of these.

Moisture is estimated by ignition, allowance being made for carbon dioxide expelled from any alkali hydrogen carbonate. L. DE K.

**Determination of Calcium as Oxalate.** By W. PAGIREFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 195—199).—In place of the ordinary procedure in the precipitation of calcium as oxalate, the author suggests a new method, consisting in adding an excess of oxalic acid to a neutral solution of the calcium salt and then neutralising with ammonia. The precipitate thus formed is more coarse-grained than that obtained in the ordinary way, can be readily separated and washed and does not pass through the filter; the composition of the precipitate obtained by either method is  $\text{CaC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$ . Should much magnesium be present, the calcium oxalate should be dissolved in acid and reprecipitated as usual. T. H. P.

**Detection of Magnesia in Calcium Oxalate Precipitates.** By H. TÄUBNER (*Chem. Zeit.*, 1902, 26, 246).—As magnesium oxalate is somewhat more soluble in water than calcium oxalate, the washings of calcium oxalate contaminated with magnesia will continue to become turbid on adding silver nitrate. This turbidity is due to silver oxalate and disappears on adding nitric acid.

Should this be the case, it may be taken for granted that the calcium oxalate is contaminated with magnesium oxalate, and it should be purified by dissolving in hydrochloric acid and reprecipitating with ammonia.

L. DE K.

**Influence of the Amount of Iron when Zinc is Titrated with Sodium Sulphide.** By A. COPPALLE (*Ann. Chim. anal.*, 1902, 7, 94—96).—In the modified Schaffner process for the volumetric estimation of zinc with standard sodium sulphide, no notice is taken of the volume occupied by the ferric hydroxide, it being generally believed that the error thus introduced is fairly compensated by the retention of some zinc in the precipitate. The author having made a long series of experiments, confirms the statement of Prost and Hassreidter that in order to get really trustworthy results the sodium sulphide should be checked with a standard zinc solution containing the same amount of iron as the zinc ore actually taken for analysis.

L. DE K.

**Volumetric Estimation of Thallium.** By VICTOR THOMAS (*Compt. rend.*, 1902, 134, 655—657. Compare Abstr., 1900, ii, 442).—A solution of thallic chloride is treated successively with excess of standard sodium thiosulphate solution, potassium iodide, and starch emulsion, the product being titrated with standard iodine solution. When the thallic solution is concentrated, the operation is conducted in a closed vessel, the precipitated thallous iodide being coagulated by agitation before the final titration. The results are accurate and are not affected by the presence of ammonium and alkali salts or excess of potassium iodide; the method is applicable to solutions of widely different concentration.

G. T. M.

**Electrolytic Estimation of Copper in Iron.** By H. KOCH (*Zeit. anal. Chem.*, 1902, 41, 105—107).—Not less than 100 grams of the iron are dissolved in dilute sulphuric acid (400 c.c. of 30° Bé) and the insoluble residue collected on a filter. If the substance is an iron rich in carbon, it is well to wash back the residue into the beaker and boil it with 200 c.c. of fresh sulphuric acid to ensure the solution of the last traces of iron, then return it to the same filter, wash, dry, and ignite. It is then dissolved in hydrochloric acid, the solution evaporated to dryness with sulphuric acid, redissolved in 20 c.c. of water and 20 c.c. of nitric acid of sp. gr. 1.2, and after diluting to 120 c.c. and adding a few drops of oxalic acid, it is electrolysed for 9—10 hours with a current density of 0.094 ampere per square centimetre.

M. J. S.

**Influence of Hydrochloric Acid on the Precipitation of Cuprous Thiocyanate.** By R. G. VAN NAME (*Amer. J. Sci.*, 1902, 13, 20—26).—The author has previously stated (Abstr., 1901, ii, 130) that free sulphuric or hydrochloric acid does not interfere with the precipitation of copper by ammonium thiocyanate. This point has been further investigated as regards hydrochloric acid, with the following results.

If only a small excess of ammonium thiocyanate is used, the free

hydrochloric acid remaining should not exceed 0.5 per cent. by volume, but a much larger amount may be present if the thiocyanate is used in decided excess; this is also advisable if ammonium salts are present. It is, on the whole, better to neutralise the greater part of the hydrochloric acid by addition of ammonium hydrogen sulphite or ammonia, or both, before precipitating the copper. L. DE K.

**Estimation of Copper as Cuprous Thiocyanate in the Presence of Bismuth, Antimony, Tin, and Arsenic.** By R. G. VAN NAME (*Amer. J. Sci.*, 1902, 13, 138—144).—Copper may be separated from arsenic, bismuth, tin, and antimony by the thiocyanate process, but in the presence of the last three metals the amount of hydrochloric acid required to prevent their precipitation interferes with the exact estimation of the copper (see preceding abstract). The amount of hydrochloric acid required may, however, be reduced to a minimum by adding 1 to 2 grams of tartaric acid.

In the presence of bismuth, an excess of ammonium hydrogen sulphite should be avoided, to prevent precipitation of that metal. After adding the tartaric acid and diluting to a definite volume, small aliquot parts of the solution are tried with the sulphite to find out how much of this may be safely added without causing the bismuth to precipitate. The main solution is then mixed with solution of ammonium hydrogen sulphite and excess of ammonium thiocyanate to precipitate the copper. In the author's experiments, the joint amount of metals was about 0.8 gram and the volume of the liquid after adding the reagents 500 c.c. L. DE K.

**Analysis of Pyritic Residues.** By A. MINOZZI (*Chem. News*, 1902, 85, 123—124).—The *sulphur* in the residues is estimated by a modification of Deutecom's method (*Abstr.*, 1880, 744). Two grams of the pyritic residue are intimately mixed in a platinum crucible with 5 grams of a mixture containing 2 parts of sodium carbonate and 1 part of potassium chlorate, 2 grams of the same mixture being spread over the whole. Heat is quickly applied, until the top layer of mixture fuses, then gradually increased and kept at the maximum, while the mass, from a pasty condition, becomes solid, then semi-fluid, and finally pasty again. When cool, the crucible with its contents is digested with 300 c.c. of warm water until the mass is completely disintegrated. The liquid is decanted through a filter, and the residue washed five or six times by decantation, each time with 50 c.c. of a 2 per cent. solution of sodium carbonate, and finally boiled; the last wash water should contain no sulphuric acid. The sulphuric acid is estimated in the combined solutions as barium sulphate. To estimate the *silica*, *lead*, *titanium*, *copper*, and *iron*, 5 grams of the pyritic residues are gently heated in a platinum crucible, while 25 grams of potassium hydrogen sulphate are gradually added; the mass is then fused. The cooled mass is treated with 500 c.c. of 2 per cent. sulphuric acid and filtered, the residue is washed with boiling water containing a small quantity of sulphuric acid, dried, ignited, and weighed. It is then moistened with 5 c.c. of 10 per cent. sulphuric acid, carefully evaporated with 20 per cent. hydrofluoric acid, treated with a small quantity of am-



monium carbonate, and ignited to constant weight; the loss is silica. The residue is fused with potassium hydrogen sulphate, digested with sulphuric acid, the solution added to the main solution whilst the residue is treated several times with a boiling concentrated solution of ammonium acetate or tartrate. The *lead* is precipitated from this solution by hydrogen sulphide, redissolved in nitric acid, and estimated as sulphate. In 100 c.c. of the main solution, the *iron* is estimated by permanganate either directly or after separation as basic carbonate when manganese, zinc, and other metals are present. The remainder of the main solution is concentrated to 300 c.c., put into a 600 c.c. flask, neutralised with ammonia, slightly acidified with hydrochloric acid and treated with sodium hydrogen sulphite. The precipitate is washed with boiling water, fused with 2 grams of a mixture of 2 parts of sodium carbonate and 1 part of potassium nitrate, the mass digested with 200 c.c. of boiling water, and any *phosphate* estimated in the solution in the usual manner; the residue is fused with potassium hydrogen sulphate, the treatment with sodium hydrogen sulphite repeated, and the *titanic acid* ignited and weighed. The solution free from phosphoric and titanous acids is treated with a small quantity of sodium hydrogen sulphite acidified with 50 c.c. of 10 per cent. hydrochloric acid, and while warm hydrogen sulphide is passed through, and the *copper* in the precipitate estimated.

D. A. L.

**Assay of Dalmatian Mercury Ores.** By C. EHLMANN and J. SLAUS-KANTSCHIDER (*Chem. Zeit.*, 1902, 26, 201—202).—These ores contain only a small percentage of mercury; the bulk consists of heavy spar. Eschka's process (condensation of the sublimed mercury on a golden lid) did not always give satisfactory results, so the following process was devised.

One gram of the finely powdered ore is heated with a little strong nitric acid and then dissolved by adding hydrochloric acid and warming until the odour of chlorine has disappeared. After diluting to 250 c.c., 100 c.c. (0.4 gram of sample) of the filtrate are precipitated with hydrogen sulphide, and the sulphides collected in a Gooch crucible containing asbestos and washed with hot water. The precipitate is dissolved in hydrochloric acid containing bromine, the excess of the latter removed by a current of carbon dioxide, and the metals are again precipitated with hydrogen sulphide. After washing with hot water, any metals of the arsenic group are removed by digesting the precipitate with yellow ammonium sulphide. Finally, the sulphides are heated with dilute nitric acid (1 : 3) which dissolves any copper or lead sulphide and leaves mercuric sulphide undissolved. This is freed from any free sulphur by digestion with solution of sodium sulphite and from any traces of lead sulphate by heating with ammonium acetate. After being well washed with hot water, it is dried at 100° and weighed. The crucible may be ignited and reweighed.

L. DE K.

**Detection of Mercury in Urine.** By AUGUST LAQUEUR (*Chem. Centr.*, 1902, i, 500—501; from *Charité-Ann.*, 26).—Cazeneuve's test with diphenylcarbazine (*Abstr.*, 1900, ii, 627), although very delicate in aqueous solutions, is not delicate enough for the detection of traces

of mercury in urine. The reaction is greatly improved by first rendering the urine strongly alkaline with sodium hydroxide, but even then it should contain a minimum of 0.19 gram of mercuric chloride per litre, a quantity not likely to occur unless in cases of serious poisoning by corrosive sublimate.

L. DE K.

**Action of Bismuth Oxide on various Metallic Solutions.** By JULES ALOY (*Bull. Soc. Chim.*, 1902, [iii], 27, 136—137).—In opposition to the statement made by Lebaigue (*J. Pharm. Chim.*, 1861, 39, 51) that oxide of bismuth when boiled for about a quarter of an hour with metallic solutions precipitates iron (ferric), chromium, and aluminium in the form of their oxides but is without action on ferrous iron, cobalt, nickel, copper, zinc, and lead, the author shows that the precipitation of the former metals is complete only under certain conditions, and that the other metals are partially precipitated either as oxides or as basic salts. Lebaigue's proposal therefore, to employ the method for the separation of the metals in analysis, cannot be adopted.

A. F.

**Action of Sodium Peroxide on the Metals of Platinum Ore.** By EMILE LEIDIÉ and QUENNESSEN (*Bull. Soc. Chim.*, 1902, [iii], 27, 179—183. Compare Abstr., 1901, ii, 62, 695).—When the metals of the platinum group are heated to a low red heat (best in a nickel dish) with sodium peroxide, sodium osmate, sodium per-ruthenate, sodium palladate, and basic sodium iridate are formed, all of which are soluble in water, the first three with a yellow, the last with a blue, coloration; platinum and rhodium yield compounds insoluble in water. On the basis of the above behaviour, and of the properties of the substances produced, the authors have drawn up a table for the detection and the characterisation of the different metals in the platinum ore.

A. F.

**Study of Fatty Acids in Contaminated Waters.** By HENRI CAUSSE (*Compt. rend.*, 1902, 134, 481—483).—The fatty acids present in contaminated waters are derived from sewage matter, the effluents of certain industries, and the decomposition of proteids. The acids are removed from the water in the form of their insoluble barium salts. These are collected and decomposed by dilute sulphuric or phosphoric acid and the product distilled under diminished pressure. The distillate is milky when the original water is contaminated; it becomes turbid and may even yield a precipitate when treated with basic lead acetate, ammoniacal barium chloride, or neutral mercurio-mercuric nitrate. The fatty acids may also be detected by extracting the distillate with chloroform and examining the residue left after evaporating the solvent; a mass of acicular crystals can be distinguished under the microscope. The acids may be isolated from the barium salts by boiling these with excess of sodium carbonate solution, filtering off the barium carbonate, acidifying the filtrate and extracting with chloroform. The fatty acids present in contaminated waters restore the colour to violet decolorised by sulphurous acid and develop a pale yellow coloration with sodium diazobenzenesulphonate.

G. T. M.

**Estimation of Prussian Blue in Spent Gas-purifying Material.** By OSCAR BERNHEIMER and F. SCHIFF (*Chem. Zeit.*, 1902, 26, 227—228).—The alkaline solution containing the ferrocyanide radicle is precipitated with a strongly acid solution of ferric chloride; the excess of acid and iron is removed by washing with boiling water containing 0.5 per cent. of ammonium nitrate, and the prussian blue precipitate is ignited. It leaves practically pure ferric oxide, which corresponds with its own weight of crystallised potassium ferrocyanide, from which the amount of ferric ferrocyanide may then be calculated.

The results obtained are a trifle higher than those obtained by Knoblauch's titration process with copper sulphate, but the authors think they are nearer the truth. The experiments will be continued.  
L. DE K.

**Modified Permanganate Method for the Assay of Commercial Glycerol.** By J. GAILHAT (*Chem. Centr.*, 1902, i, 544; from *Mon. sci.*, [iv], 16, i, 89—106).—Purified glycerol is diluted with about 20 per cent. of water, and its sp. gr. is then taken. By means of this liquid, a dilute glycerol is prepared containing 5.9 grams of anhydrous glycerol per litre. The sample to be tested, freed, if necessary, from objectionable products by means of silver nitrate and lead acetate, is also diluted to about the above strength. Both liquids are now titrated by boiling 25 c.c. of each with a mixture of potassium permanganate, manganous sulphate, and dilute sulphuric acid for half-an-hour in a reflux apparatus; 10 c.c. of *N*/2 oxalic acid are added, and the excess of this is titrated with *N*/10 potassium permanganate. The exact amount of available oxygen in the permanganate mixture is also estimated by means of oxalic acid and *N*/10 permanganate. The amount of glycerol in the sample is then found by a simple calculation.  
L. DE K.

**Nitroglycerol in an Exhumed Body.** By G. G. POND (*J. Amer. Chem. Soc.*, 1902, 24, 18—20).—The poison was isolated by heating the comminuted material (one-fourth of the stomach and contents) in a current of steam after adding 50 c.c. of water and acidifying with tartaric acid (Dragendorff's process). The turbid distillate was extracted with ether, and the oily residue left on evaporating the ethereal solution gave the usual tests for nitroglycerol, the most characteristic one being the explosions occurring when heated on a platinum spoon, or when struck on an anvil. The weight amounted to 0.0095 gram.  
L. DE K.

**Polarimetric Determination of Lactose.** By A. PEYTOUREAU (*Ann. Chim. anal.*, 1902, 7, 88—91).—A criticism of the method described by Denigès for estimating crystallised lactose in milk by polarisation after removing the proteids by the aid of picric and acetic acids, (*Précis de Chimie analytique*, 1898, 686).

The author uses a 20 cm. tube and substitutes the equation  $x = 2DD'/D - D' \times 0.062$  gram for  $x = 2DD'/2D - D' \times 0.062$  gram.

L. DE K.

**Estimation of Raffinose.** By GUSTAV REINHARDT (*Zeit. Ver. deut. Zuckerind.*, 1902, 114—116).—The author has made experiments on the action of animal charcoal extracted with hydrochloric acid and of blood charcoal on inverted solutions of pure sucrose and of sucrose mixed with various proportions of commercial raffinose. In the case of pure inverted sucrose, slight absorption takes place with the extracted animal charcoal, whilst the blood charcoal has a somewhat greater effect. When raffinose is present, however, the laevorotation in some cases undergoes considerable increase, which is greater for the blood charcoal. When less than 2.5 per cent. of raffinose is present, the diminution and increase of the laevorotation due to the absorption of the inversion products of sucrose and raffinose respectively balance one another, but when this proportion is exceeded considerable errors may be made in the analysis, which gives more sucrose and less raffinose than are really present. These results the author considers to be due to the greater absorption of the melibiose formed by the inversion of raffinose.

T. H. P.

**Testing of Honey.** By WALTER BRÄUTIGAM (*Chem. Centr.*, 1902, i, 681—682; from *Pharm. Zeit.*, 47, 109).—The author has found that genuine honey contains a kind of albumin, probably secreted by the bees, as it is also present when these have been fed on cane sugar. The following reactions may serve to distinguish genuine from factitious honey.

Three grams of honey are dissolved in 3 c.c. of water, an equal volume of saturated brine is added, the solution is acidified with acetic acid, and boiled. In genuine samples, a decided separation of albumin is noticed. The albumin obtained from 25 grams of honey after being freed from sodium chloride should dissolve on warming in 4 grams of acetic acid; the liquid becomes turbid on cooling owing to the presence of wax, which, however, dissolves on adding a few drops of chloroform. The filtrate from the albumin is mixed with an excess of ammonia, when on heating to 50° a flocculent precipitate (? peptone) will appear. (Egg-albumin gives no precipitate, blood-albumin only a slight one.) One-tenth part of this filtrate is mixed with a drop of phenol and heated; there should be no turbidity (absence of blood-albumin). The remainder of the filtrate is mixed with dilute aqueous sodium hydroxide and heated to 50°, when it should remain clear (absence of blood and egg-albumin).

L. DE K.

**Estimation of Dry Extract in Wines.** By EDWIN ACKERMANN (*Ann. Chim. anal.*, 1902, 7, 87—88).—Ten c.c. or less of the sample are introduced into a weighed platinum dish having a diameter of 5.5 cm. and a height of 1.5 cm., evaporated first on the open water-bath for 20 minutes, and then dried for an hour in a Moeslinger water-oven. The residue is then weighed. If the ash has to be estimated, the dish is placed on an aluminium plate and heated until the mass is charred; if now heated over the naked flame, the carbon will burn with remarkable facility.

L. DE K.

**Estimation of Potato-Starch (Granulose).** By ALBERT KAISER (*Chem. Zeit.*, 1902, 26, 180).—Fifty c.c. of the 1 per cent. starch solu-



tion, which must be freshly prepared, are mixed with 10 grams of sodium acetate, heated to  $50^{\circ}$ , and precipitated with a slight excess of iodine solution (5 grams of iodine and 10 grams of potassium iodide in one litre). The precipitate is collected on a weighed filter and washed with a 3 per cent. solution of sodium acetate. After transferring it from the filter into a porcelain dish by aid of a jet of alcohol from a wash-bottle, it is gently heated with 5 c.c. of a 5 per cent. alcoholic solution of potassium hydroxide, which soon decomposes the starch iodide, leaving amorphous starch. The liquid is now rendered decidedly acid by means of an alcoholic solution of acetic acid and the starch collected on the same filter, washed first with hot alcohol, then with absolute alcohol, and finally with ether. After drying for 4 hours at  $120^{\circ}$ , it is weighed. It should then be tested for any insoluble matter.

L. DE K.

**A New Method for the Estimation of Cellulose.** By SIMON ZEISEL and MILAN JOSEF STRITAR (*Ber.*, 1902, 35, 1252—1255).—About 1—1.5 grams of the finely divided material are mixed with dilute nitric acid and a 3 per cent. aqueous solution of potassium permanganate gradually added to the well-cooled and constantly stirred mixture until a coloration is produced which is permanent after half-an-hour; after removing the excess of permanganate and precipitated manganese dioxide by the aid of sulphurous acid, the residue is thoroughly washed with water, digested with  $2\frac{1}{2}$  per cent. ammonia at  $60^{\circ}$  for  $\frac{3}{4}$  hour, washed with alcohol and ether, and weighed. This method gives results slightly lower than that of Schulze and Henneberg, 37.2 per cent. of cellulose being found in oak-wood, instead of 45.87 per cent.; the product, however, was purer, as shown by the absence of methoxyl groups. Schulze's method, moreover, gives very variable results according to the conditions.

W. A. D.

**Estimation of Acetic Acid in Lead Accumulators.** By CARLO FORMENTI (*Chem. Zeit.*, 1902, 26, 150—151).—Two kilos. of the cut up material are boiled in the water and 50 grams of potassium carbonate; the filtrate is evaporated to dryness and heated for some time at  $100^{\circ}$ . The potassium acetate is extracted by absolute alcohol, the solution is evaporated to dryness, and the residue again dissolved in alcohol. The potassium acetate is then obtained pure by evaporating the solution in a platinum dish and drying the residue at  $100^{\circ}$ . After weighing, it may be identified by the cacodyl reaction and other tests for acetates.

L. DE K.

**Detection of Acetoacetic Acid in Urine.** By ED. ALLARD (*Chem. Centr.*, 1902, i, 443; from *Berl. Klin. Wochschr.*, 38, 985—987).—Gerhardt's test will detect the presence of 0.4—0.5 part of acetone in 1000 parts of urine; Arnold's test (*Abstr.*, 1900, ii, 768) shows 0.1 per 1000, and Liplawsky's combination of the above tests will show as little as 0.04 per 1000. For the latter, concentrated ammonia and hydrochloric acid of sp. gr. 1.19 should be used. Both Arnold's and Liplawsky's test (*Abstr.*, 1901, ii, 428) also give a reaction with acetone, a fact of which these authors do not seem to have been aware,

but this is not of much importance, as no acetone reaction is obtained with less than 1 per cent. [ $\frac{1}{1000}$ ]. Of the various reagents for acetoacetic acid, ferric chloride is therefore the only one not affecting acetone.

L. DE K.

#### Detection and Estimation of Lactic Acid in Gastric Juice.

By ALEXANDER CH. VOURNASOS (*Zeit. angew. Chem.*, 1902, 15, 172—174).—Five c.c. of the gastric juice are filtered and, if the filtrate is slimy, diluted with an equal bulk of water. The solution is rendered alkaline by adding a 10 per cent. solution of potassium hydroxide and boiled for a few minutes, then at once mixed with 1—2 c.c. of a reagent composed of 1 part of iodine, 0.5 of potassium iodide, 5 parts of methylamine, and 50 of water. If lactic acid is present in the proportion of at least 0.005 per cent., a very strong odour of isonitrile will be noticed after some time. Sometimes it is advisable to expel volatile substances and then extract the lactic acid by means of ether before applying the test.

For the quantitative analysis, the following procedure is recommended. Thirty c.c. of the juice are evaporated to 10 c.c. and mixed in a retort with 15 c.c. of aqueous potassium hydroxide and 0.5 gram of iodine; the retort is connected with a properly cooled receiver and the mixture distilled first at a low temperature and finally at 105° until 7/10 of the liquid has passed over. The distillate contains an amount of iodoform corresponding with the quantity of the lactic acid present. It may either be collected on a tared filter, dried at 60°, and weighed, or it may be decomposed with alcoholic potassium hydroxide and the iodine estimated volumetrically with  $N/10$  silver nitrate. 0.1 gram of iodoform corresponds with 0.0229 gram of lactic acid. The liberated iodoform may also be identified by aid of the microscope.

L. DE K.

#### Action of Bromine and Potassium Permanganate on Citric Acid (Stahre's Reaction) and Detection of Citric Acid in Milk.

By ALFRED WÖHLK (*Zeit. anal. Chem.*, 1902, 41, 77—100).—The highly sensitive reaction for citric acid published by Stahre (*Abstr.*, 1897, ii, 290), namely, the production of a white precipitate, soluble in ether, when bromine and potassium permanganate act on citric acid, does not depend, as was supposed by him, on the bromination of acetone produced by the oxidation of the citric acid. The precipitate consists essentially of pentabromoacetone, if it is formed at the ordinary temperature, although above 45° the principal product is bromoform. Acetone cannot, however, be brominated by bromine water either in diffused daylight or in direct sunlight. Neither is the reaction due to a direct bromination of citric acid, as that acid is recovered unaltered after repeated evaporation with bromine water. The action of an oxidising agent is essential, but manganic acetate, manganic hydroxide, manganese dioxide, ferric, cobaltic, nickelic hydroxides, or lead dioxide can be substituted for the permanganate. The author confirms the production of acetone when citric acid is oxidised by permanganate, but shows that the action takes place in two stages, the first of which corresponds with the formation of acetonedicarboxylic acid. Moreover, Denigès, by his mercuric sulphate test (*Abstr.*, 1900, i, 204), has shown

that acetonedicarboxylic acid is present in the product of the oxidation of citric acid by permanganate, and the author has obtained indications of the presence of a substance of enolic constitution in a solution of citric acid oxidised by a ferric salt in sunlight, by the production of a violet colour with the first portions of bromine added. Now acetonedicarboxylic acid readily yields pentabromoacetone when treated with bromine water at 15°, but at the same time a large part of the acid splits up into acetone and carbon dioxide. Stahre's reaction is therefore not a quantitative one. The test is performed by warming the mixture of citric acid (or a citrate acidified with sulphuric acid) and permanganate to 30—40°, removing any brown colour by addition of ammonium oxalate, and then adding a few drops of bromine water. For Denigès' test, which is even more sensitive than Stahre's, although less characteristic, since various ketones, ketonic acids, and aldehydes give a similar result, 5 grams of mercuric oxide are dissolved in 20 c.c. of concentrated sulphuric acid and 100 c.c. of water, one volume of this reagent is added to 20 vols. of the citric acid solution, the mixture heated to boiling, and then a few drops of permanganate are added. A white precipitate is immediately produced.

From 10 litres of cow's milk, the author has obtained several grams of rhombic crystals, which not only gave Stahre's, Denigès', and the ordinary calcium salt reactions, but which, when converted into silver and calcium salts, gave, on elementary analysis, numbers agreeing with those required by citric acid.

M. J. S.

**Estimation of Citric Acid in Milk.** By GEORGES DENIGÈS (*Compt. rend. Soc. Biol.*, 1902, 54, 197—198).—Ten c.c. of milk, 2 c.c. of a 5 per cent. solution of sodium metaphosphate, and 3 c.c. of mercuric sulphate are mixed and filtered. Half the filtrate (about 7.5 c.c.) is mixed with 0.5 c.c. of a 10 per cent. solution of manganese sulphate and boiled. To this, 4 drops of a 2 per cent. solution of potassium permanganate are added and the mixture again boiled; this is repeated, and the fluid decolorised by a drop of hydrogen peroxide; an opalescence or a precipitate indicates the presence of citric acid. For quantitative purposes, the depth of the opalescence is compared with that in standard tubes previously prepared.

W. D. H.

**Decrease in the Acidity of Milk.** By ARTHUR KIRSTEN (*Zeit. Nahr.-Genussm.*, 1902, 5, 97—109).—Many experiments are described showing that the acidity of milk decreases when the milk is kept in open vessels; also when it is boiled or subjected to centrifugal action. This is due to a partial loss of the carbon dioxide dissolved in the milk. It is further pointed out that the acidity of fresh milk is not alone due to acid phosphates, but in part to dissolved carbon dioxide.

The so-called "incubation stage" of milk, discovered by Soxhlet, until now defined as the period during which the acidity of milk remains constant in spite of the increase of acid-producing bacteria, is better described, in the light of the author's experiments, as that period in which the lactic acid bacteria produce only as much lactic acid as is balanced by the loss of free carbon dioxide. During the "incubation stage," the acidity may even decrease.

W. P. S.

**"Butter Oil."** By F. URZ (*Zeit. öffentl. Chem.*, 1902, 8, 48—49).—A sample of cooking oil sold in Germany under the name of "butter-oil" was found to consist entirely of cottonseed oil. An article imported from America as "cooking fat" was found to be a mixture of 95 per cent. of cottonseed stearin with 5 per cent. of beef stearin. Another substance—nut butter—was simply a mixture of earthenut meal and earthenut oil.

W. P. S.

**Analysis of Turkey-Red Oil.** By W. HERBIG (*Chem. Rev. Fett. Harz. Ind.*, 1902, 9, 5—8).—The combined sulphuric acid is estimated by boiling 4 grams of the sample with 30 c.c. of dilute hydrochloric acid (1 : 5) for about 40 minutes in a reflux apparatus; it is necessary to shake the mixture frequently. Both the acid and fatty layer should be quite clear, and when cold the latter is dissolved by addition of ether. The whole is now introduced into a separating funnel, the acid layer is drawn off, and the ethereal layer freed from any acidity by shaking three times with a little water. After expelling the ether from the acid solution, this is, as usual, precipitated with barium chloride. The total fatty matter is estimated by heating 30 grams of the sample with 100 c.c. of water and adding 25 c.c. of dilute sulphuric acid. To the mixture, which is contained in a 200 c.c. flask having a long neck graduated to 0.1 c.c., is then added hot brine until the fatty mass has collected in the neck. After half-an-hour its volume is read off, and in calculating this to weight, its sp. gr. may be assumed to be 0.945.

It appears that when boiled with dilute acids triglycerides lose part of the glycerol. To what extent this affects the analysis of turkey-red oil will be the subject of a further investigation.

L. DE K.

**Halphen's Reaction.** By A. STEINMANN (*Ann. Chim. anal.*, 1902, 7, 85—87).—Many inconveniences experienced when applying Halphen's reaction may be avoided by the simple plan of heating the mixture of the oil with amyl alcohol and solution of sulphur in carbon disulphide in a sealed tube. The tube is partly filled by the well-known device of warming it and dipping the drawn-out end into the mixture; the point is then sealed. There is very little risk of the tube breaking if it is put into cold water, which is then gradually heated to boiling. A tube fitted with a tied-down glass stopper may also be used.

L. DE K.

**The Chemistry of Halphen's Reaction for Cottonseed Oil.** By PAUL N. RAIKOW (*Chem. Zeit.*, 1902, 26, 10—11).—It is known that cottonseed oil mixed with sulphur and exposed for a long time to sunlight becomes indifferent towards Halphen's reagent. The author has noticed that exposure to sunlight alone will gradually diminish the quantity of the active substance causing the reaction; slight traces of added sulphur have no sensible effect.

L. DE K.

**Estimation of Fat in Bread and Determination of the Nature of the Fat.** By T. C. BERTROP (*Zeit. angew. Chem.*, 1902, 15, 121—125).—One hundred and fifty grams, or more, of the sample are boiled in a reflux apparatus with 500 c.c. of water and 100 c.c. of hydro-



chloric acid for 2 hours over the naked flame. (When testing flour, the mixture should be heated first for one hour in the boiling water-bath.) When cold, the insoluble matter is collected on a filter, washed with cold water until the acidity is removed, and then dried for an hour at 100—110°. The mass, which can be readily detached from the filter is reduced to powder in a mortar with addition of some sand, the paper cut into small pieces, and the whole introduced into a fat-free paper cartridge and extracted in a special apparatus for one hour with ether, light petroleum, or carbon tetrachloride. The apparatus consists of a flat bottomed, cylindrical boiling flask, 4 cm. wide and 11.5 cm. high, having a ground neck connected with an open cylinder, the top of which is fitted with a perforated cork through which passes the condensing tube. By means of two strings fitted to it, the cartridge may be pulled up so that the contents may be extracted for the first half hour when actually in contact with the boiling liquid contained in the flask. Experiments are communicated to show that the extraction of the fat is complete, and that previous ideas about fat disappearing during the baking process were solely due to the fact that the old extraction processes used in the case of bread were untrustworthy. The process may also be applied to the analysis of condensed milk.

The fat contained in wheaten flour averages 1.68 per cent.; any large excess, therefore, points to added fatty matter. To see whether this is due to the use of milk, the Reichert-Meissl number of the extracted fat should be taken. Pure wheaten flour fat has a Reichert-Meissl figure of 1.8; a lower figure points to the presence of fats of the margarine type. When calculating the results obtained with bread, it may be assumed that 100 parts of dry bread contain 90 parts of dry flour.

L. DE K.

**Methods of estimating Fat in Fodders.** By C. BEGER (*Chem. Zeit.*, 1902, 26, 112—113).—The author is of opinion that in accurate scientific work the fatty matter should be rendered accessible to solvents by removing any albuminous matters by Dormeyer's pepsin process. Three or five grams of the substance are digested with 480 c.c. of water and 20 c.c. of 25 per cent. hydrochloric acid for 24 hours at 37—40° after adding 1 gram of Merck's pepsin. Both residue and liquid are then extracted with ether. A number of cases are given showing the value of the method. One sample of gluten which gave 0.85 per cent. of fat by the ordinary Soxhlet treatment yielded 5.74 per cent. by the pepsin process.

L. DE K.

**Rapid Detection of Formaldehyde in Foods.** By CARL ARNOLD and CURT MENTZEL (*Chem. Zeit.* 1902, 26, 246—247).—The following test may be applied directly to liquid foods or an aqueous or alcoholic extract of solid foods.

In 3—5 c.c. of the liquid (milk, for instance) is dissolved a lump of phenylhydrazine hydrochloride the size of a pea, 2—4 drops of a 5—10 per cent. solution of sodium nitroprusside are added, and finally 8—12 drops of 10—15 per cent. sodium hydroxide. In the presence of even traces of formaldehyde, a fairly permanent blue or bluish-green

colour is produced. The test is rendered still more delicate by substituting potassium ferricyanide for the nitroprusside, but it cannot then be recommended for milk or meat preparations containing blood-colouring matter; in case of an alcoholic solution, this must be well diluted with water to prevent precipitation of potassium ferricyanide.

L. DE K.

**Method for the Detection of Glucosamine and its Employment on the Decomposition Products of Mucin.** By H. STEUDEL (*Zeit. physiol. Chem.* 1902, 34, 353—384).—See this vol., i, 399.

**Occurrence and Detection of Berberine in Plants.** By HARRY M. GORDIN (*Arch. Pharm.*, 1902, 240, 146—149).—It has been customary to add excess of hydrochloric acid to the aqueous or alcoholic extract of the plant, and, if a yellow precipitate is produced the solution of which in water is reddened by chlorine water, to conclude that berberine is present. This method is untrustworthy.

The powdered drug (5—20 grams) should be extracted with hot alcohol, the extract evaporated, the residue diluted with 20—40 c.c. of water, filtered (after the addition of a little powdered talc, if necessary), and a few c.c. of the clear filtrate mixed with 10 per cent. potassium iodide solution. If no precipitate is formed, no appreciable quantity of berberine is present. If a precipitate forms, 10 c.c. of the original clear filtrate are mixed with 1 or 2 c.c. of 10 per cent. aqueous sodium hydroxide, filtered if necessary, heated to 50°, mixed with 5 c.c. of acetone, and set aside. If no crystals of berberine-acetone have appeared after 2 hours, 30 c.c. of water are added, and the whole is left overnight in a cool place. Crystals will separate if not less than 0.01 gram of berberine was present in the original 10 c.c. They may be identified by washing them with water, dissolving them in very dilute hydrochloric acid, and testing portions of the solution with potassium iodide, potassium dichromate, picric acid, and chlorine water.

*Berberis vulgaris* and *B. Aquifolium*, *Hydrastis canadensis*, *Xanthorrhiza aquifolia*, and *Coptis trifolia* contain berberine; *Cocculus palmatus*, *Pareira brava*, *Menispermum canadense*, and *Jeffersonia diphylla* do not.

C. F. B.

**Behaviour of Morphine and Strychnine in Putrefying Corpses.** By WILHELM AUTENRIETH (*Chem. Centr.*, 1902, i, 376—377; from *Ber. Deutsch. pharm. Gesel.*, ii, 494—502).—Morphine is but little affected by the putrefaction process, but strychnine is partially decomposed, or at least so altered that the products give no reaction with sulphuric acid and potassium dichromate. For the detection of morphine or strychnine, the author uses the Stas-Otto process, substituting, however, hot chloroform for amyl alcohol; when testing urine, this is acidified with tartaric acid and first evaporated to a syrup. If the alkaloidal residue looks greasy, it is dissolved in water containing 1 per cent. of hydrochloric acid, and the filtered liquid is then rendered alkaline and agitated with ether to dissolve the alkaloid.

In acute opium poisoning, the meconic acid passes unchanged into

the urine. In a sample of urine which had been exposed for 15 months, the alkaloid could still be detected, but no reaction could be obtained for meconic acid.

L. DE K.

**Analysis of Rubber Wares.** By ARVID HEINTZ (*Chem. Zeit.*, 1902, 26, 247—248).—The various matters added to rubber, such as fats, asphalt, "factis," &c., are removed by means of suitable solvents, alcoholic potassium hydroxide, ether, nitrobenzene, &c. The residue is then sharply dried and an aliquot part is burnt with lead chromate in a combustion tube. From the weight of the water formed the quantity of true rubber may be calculated, assuming it to consist of a hydrocarbon,  $C_{10}H_{16}$ .

L. DE K.

**New Reagent for the Detection of Albumin in Urine.** By EGIDIO POLLACCI (*Chem. Centr.*, 1902, i, 224—225; from *Boll. Chim. Farm.*, 40, 789—791).—A modification of Spiegler's test. One gram of tartaric acid, 5 grams of mercuric chloride, and 10 grams of sodium chloride are dissolved in 100 c.c. of water, filtered, and mixed with 5 c.c. of 40 per cent. formaldehyde. The test is made by carefully pouring 3—4 c.c. of the urine on to 2 c.c. of the reagent. An immediate white ring forming at the place of contact shows pathological albumin, but the reaction is so delicate that even in normal urines a slight ring generally shows after 8—15 minutes. A table is given showing the comparative delicacy of this and several other reagents. One part of albumin may be detected in 370,000 parts of solution; the nitric acid (Heller) test only shows one in 78,000.

L. DE K.

**Solution and Estimation of Coagulated Proteids by Thiosinamine.** By OEFELE (*Chem. Centr.*, 1902, i, 502; from *Pharm. Centr.-Halle*, 43, 1—4).—The author has found that thiosinamine dissolves coagulated albumin and uses this reaction for the isolation of proteids in fæces. A portion of the sample is mixed to a paste with sand, thiosinamine, and a little water, and digested on the water-bath. The mass is then thrown on to a filter and repeatedly extracted with boiling water; the filtrate contains the proteids, the thiosinamine, and a number of substances soluble in alcohol. The proteids may be removed by means of picric acid or the solution after being concentrated is repeatedly precipitated with excess of absolute alcohol. The normal quantity of coagulated proteids soluble in thiosinamine contained in fæces amounts to 4—8 per cent.

L. DE K.

**Analysis of Meat Extracts and Vegetable Extracts.** By KARL MICKO (*Zeit. Nahr.-Genussm.*, 1902, 5, 193—201).—The results of the analyses of various meat and vegetable extracts are given, the usual methods being employed for the separation of the different constituents. The amounts of creatine (or creatinine respectively) and of xanthine bases contained in the extracts are also given. For the estimation of the creatine, from 5 to 20 grams of the extract are boiled with 100 c.c. of water and 10 c.c. of dilute sulphuric acid (1 : 3) for 3

hours under a reflux condenser. The liquid is then neutralised with sodium hydroxide, the xanthine bases are precipitated with sodium hydrogen sulphite and copper sulphate, and filtered off. The excess of copper is removed from the filtrate as sulphide and the filtrate evaporated to a syrupy consistency. The residue so obtained is thoroughly extracted with boiling alcohol, the alcoholic solution evaporated to about 300 c.c., neutralised with alcoholic sodium hydroxide, filtered, and precipitated by the addition of 0.5 c.c. of a concentrated alcoholic solution of zinc chloride. The precipitate of creatinine-zinc chloride which forms is collected, as is also a further quantity obtained on concentrating the solution to about 40 c.c. The nitrogen in the precipitates is then estimated by Kjeldahl's method. Approximately 6 per cent. of creatine was found in Liebig's extract.

The xanthine bases may be determined by dissolving 10 grams of the extract in 100—200 c.c. of boiling water and precipitating by adding 40 c.c. each of saturated sodium hydrogen sulphite solution and a 13 per cent. solution of copper sulphate. After remaining overnight, the precipitate is collected, washed with previously boiled cold water, and boiled with a little water acidified with hydrochloric acid. The copper is then removed as sulphide and the cold solution precipitated with silver nitrate solution in the presence of excess of ammonium hydroxide. After 12 hours, the precipitate is collected, washed with dilute ammonia, then with water, and brought into a flask, where, after the addition of hydrochloric acid, the silver is removed as sulphide. The filtrate from the silver sulphide is concentrated by evaporation and reprecipitated with silver nitrate. The precipitate obtained is washed completely with water, then with alcohol, and the nitrogen it contains estimated. The filtrate from the copper hydrogen sulphite precipitate still contains a small quantity of xanthine bases. These may be estimated, after removal of the copper, by precipitation with silver nitrate as above, the amount of nitrogen found being added to the first quantity. Liebig's extract contained an average of 0.648 per cent. of nitrogen as xanthine bases; "Sitogen" (yeast extract), 0.637 per cent. Whether the nitrogen in the silver precipitate exists solely as xanthine bases has not yet been determined, nor is it known whether the latter are identical in both meat and vegetable extracts.

W. P. S.

**Alkalimetric Estimation of Disodium Methylarsenate (Arrhenal).** By A. Astruc (*Compt. rend.*, 1902, 134, 660—661).—The salt  $\text{Na}_2\text{AsMeO}_3 \cdot 5\text{H}_2\text{O}$  is neutral to Poirrier's blue, but alkaline to litmus, rosolic acid, phenolphthalein, or helianthin-A.

On titrating the aqueous solution with a mineral acid, neutrality is attained in the presence of litmus or rosolic acid by the employment of 1 equivalent of the reagent, the end points being especially distinct in the case of the latter indicator. Under these conditions, the solution remains alkaline to helianthin-A until  $1\frac{1}{2}$  to 2 equivalents of acid are added, but in this case the end point is ill-defined, and a similar result is obtained with phenolphthalein (compare Abstr., 1901, ii, 144).

G. T. M.



**Analysis of the Apple and some of its Products.** By C. A. BROWNE (*J. Amer. Chem. Soc.*, 1901, 23, 869—884).—*Moisture*.—As lævulose and other substances cannot be dried at 100° without suffering decomposition and loss in weight, the author mixes the pulp or the juice of the apple with asbestos contained in a perforated copper tube and dries at 70° for 8 or 10 hours in “a vacuum of about 25 inches.” During the first few hours of the drying, a slight air-current is passed to more readily remove the excess of moisture. The percentage of solid matter in unfermented apple juices may also be determined in a sufficiently accurate manner by using the formula  $245 (S-1)$ , in which  $S$  represents the sp. gr. of the juice at 17.5°. *Ash*.—This is determined in the usual way, the charred mass being exhausted with water before being completely burned; the aqueous solution is evaporated separately. *Reducing sugar*.—One hundred grams of the grated pulp are repeatedly washed on a muslin filter with cold water, the filter being each time squeezed to hasten the removal of the sugar. The washing is continued until nearly two litres of liquid are collected; after carefully making up to the mark and shaking, 200 c.c. of the filtered liquid are transferred to a 250 c.c. flask, neutralised with sodium hydroxide, using phenolphthalein as indicator, and diluted to the mark. Twenty-five c.c. of this solution (1 gram of apple) are then used for the estimation; the cuprous oxide is reduced as usual by hydrogen, and the metallic copper weighed. *Sucrose*.—This is estimated by the increase in cupric reducing power after heating the solution for 5 minutes at 70° with addition of 10 per cent. by volume of fuming hydrochloric acid. It may also be determined by polariscopic observation before and after inversion. *Lævulose and dextrose*.—These may be calculated from the rotation and cupric reducing power of the solution, advantage being taken of the fact that on raising the temperature lævulose gradually loses its polarising power. *Starch*.—The liquid prepared for the estimation of the reducing sugars contains in suspension the starch which gradually deposits, and may then be washed by decantation. After finally washing it on a hardened filter, it may be dissolved by means of diastase, inverted by hydrochloric acid, and determined by the copper process. *Marc*.—This is the insoluble part of the fruit. The residue left on the muslin filter is transferred to a dish and dried at 100°. With the exception of a trace of ash, it is almost wholly composed of cellulose, lignin, and pentosans. The last named may be estimated as usual by conversion into furfuraldehyde, and precipitating this by phloroglucinol; cellulose may be estimated by Cross and Bevan's chlorination process, lignin being found by difference. *Malic and acetic acids*.—Malic acid is found by titration with  $N/10$  soda, combined acid being calculated from the alkalinity of the ash. In the case of ciders and vinegars, the acetic acid may be determined separately by distillation in a current of steam and subsequent titration; the residue is then titrated for malic acid. *Pectin*.—A definite volume of the extract or juice is evaporated to a small volume and precipitated with excess of alcohol. The precipitate is afterwards collected in a Gooch crucible, washed with alcohol, dried at 100°, and weighed. It is then burnt and any ash allowed for. Tables are given showing the average composition of the flesh of the ripe apple,

the composition of apple ash, apple juices, ciders, vinegars, other apple products and other fruits for comparison. L. DE K.

**Cocoa-Shell Powder.** By PAUL WELMANS (*Zeit. öffentl. Chem.*, 1901, 7, 491—500).—The results are given of a number of determinations of the amounts of shell or husk obtained from raw and roasted cocoa beans. On the raw beans, the quantity varied from 8.00 to 17.72 per cent., with an average of 13.30 per cent., and on the roasted beans from 9.60 to 16.00 per cent., the average being 12.40 per cent. Analyses are also given of various samples of cocoa powder. As regards the estimation of the quantity of added cocoa-shell powder in cocoas, the author recommends the determination of the percentage of ash; the iodine number and acidity of the fat obtained from the sample; the amount of cold water extract; the crude fibre, and the pentosans. The fat in cocoa-shell powder is about 7.5 per cent., having 35.3° of acidity (Burstyn degrees). The iodine number of the fat is about 45 per cent. The cold water extract averages 24.6 per cent., and the ash, 8.60 per cent. The average percentage of crude fibre in the shell powder is 12.3. The percentage of pentosans (as determined by the phloroglucinol method) gives the best indication of admixture as the quantity present in cocoa-shell powder is about 8.5 per cent., whilst ordinary Dutch cocoa contains approximately 2 per cent. W. P. S.

**Oats-Cocoa.** By R. PETERS (*Chem. Centr.*, 1902, i, 332—333; from *Pharm. Centr.-Halle*, 1901, 42, 819—828).—Oats-cocoa consists of a mixture of 33.5—60 per cent. of cocoa powder, freed from oil, with 40—60 per cent. of prepared, or more usually ordinary, oatmeal, and in some cases small quantities of nutritive salts are also present.

The percentages of cocoa powder and oatmeal may be determined as follows. The sample is examined microscopically to ascertain whether it consists of a mixture of oatmeal and cocoa only. The fat is then extracted, weighed, and its iodine number determined. Assuming the iodine number of oil of oats to be 98, and that of cocoa butter 36, the proportion of these materials in the fat may be calculated, and since oatmeal contains on an average 6 per cent. of oil, the percentage of oatmeal in the original powder is readily found. The cocoa powder is estimated by difference.

The extracted fat should be tested for the presence of adulterative fat which would have an iodine number less than 36. If cocoa butter has been added the fat would give an extraordinarily low iodine number, and in this case the ash should be determined. The quantity of cocoa powder may then be calculated from the average percentages of ash yielded by oatmeal and cocoa powder respectively. If the value thus obtained is considerably less than that calculated from the iodine number, then cocoa butter has doubtless been added. In the original paper, a table is given showing the maximum iodine numbers of the fats extracted from oats-cocoas containing 33½, 40, 50, and 60 per cent. of cocoa powder respectively. In the case of samples which contain other components, the quantity of oatmeal is found as before, but that of the cocoa powder is estimated by assuming that it contains 27 per cent. of fat. E. W. W.

## General and Physical Chemistry.

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**Indices of Refraction of Mixed Liquids.** By EDMOND VAN AUBEL (*Compt. rend.*, 1902, 134, 985—987).—The author has examined the relationship developed by Leduc (*Compt. rend.*, 1902, 134, 645):  $(N-1)U = m(n-1)u + (1-m)(n'-1)u'$ , where  $m$  is the weight of one of the constituents,  $u$ ,  $u'$ , and  $U$  are the specific volumes of the constituents and mixture respectively, and  $n$ ,  $n'$ , and  $N$  their refractive indices. The formula gives good results for mixtures of acetone and water (Drude, *Abstr.*, 1897, ii, 438) and aniline and ethyl alcohol (Johst, *Ann. Phys. Chem.*, 1883, [ii], 20, 9). It is shown that the value of  $(n-1)/d$  is not constant for various mixtures.

J. McC.

**Maxwell's Law,  $n^2 = K$ , for some Compounds containing Nitrogen.** By EDMOND VAN AUBEL (*Compt. rend.*, 1902, 134, 1050—1052).—In the case of nitro-compounds, nitrates, amines, and nitriles, Maxwell's law connecting the refractive index with the dielectric constant is not valid. With these substances, the dielectric constant diminishes as the molecular weight rises whilst the refractive index increases.

J. McC.

**Lamps for Spectra. IV.** By ERNST BECKMANN (*Zeit. physikal. Chem.*, 1902, 40, 465—474. Compare *Abstr.*, 1900, ii, 701; 1901, ii, 53, 81).—In order to prevent solid particles of material used in the production of coloured flames from coming into the air, the burned gas should be aspirated by a falling current of water into the bottom of a vessel the upper part of which contains fat-free cotton wool. Washing with water is not sufficient to remove these solid particles. With the Morton form of sprayer, a good coloured flame can be obtained; the air-blast, carrying the solid, enters into a chamber, from which it passes to the burner.

A simple lamp, suitable for chemical laboratories, is made by attaching a right-angled sprayer to a wide tube which contains a drop-collector and is connected with the bottom of an ordinary metal burner. The gas pressure may be conveniently obtained from a cylinder of compressed air or oxygen.

J. McC.

**Band Spectra of Nitrogen.** By HENRI DESLANDRES (*Compt. rend.*, 1902, 134, 747—750).—It is shown that the expression  $N = 22785.1 - \frac{30.318}{8}(2n)^2 + \frac{29.363}{8}(2p+1)^2$ , where  $n$  and  $p$  vary by successive additions of unity, accurately gives the position of the whole 42 bands of the first group of bands in the spectrum of nitrogen (Compare Cuthbertson, *Phil. Mag.*, 1902, [vi], 3, 348). L. M. J.

**Some New Peculiarities in the Structure of the Cyanogen Bands.** By ARTHUR SCOTT KING (*Ann. Physik*, 1902, [iv], 7, 791—800).—An investigation of the arc light spectrum, dealing

specially with a series of bands in the ultra-violet which have not been described by previous workers. The author regards the band structure referred to as the "tails" of the cyanogen bands; the new bands are affected by change of the atmosphere surrounding the arc in the same way as the edges of the cyanogen bands. The influence of atmospheres of carbon dioxide, nitrogen, and oxygen on the character of the carbon bands and the cyanogen bands is described. The carbon used in the investigation was prepared by ignition of pure sucrose.

J. C. P.

**Ultra-violet Absorption Spectra.** By G. PAUL DROSSBACH (*Ber.*, 1902, 35, 1486—1489. Compare this vol., ii, 190).—The author has extended his observations to salts of the rare earths and to several organic liquids. Using the same notation (*loc. cit.*) to represent ultra-violet absorption, it is found that methyl and ethyl alcohol are completely transparent, whilst the higher alcohols have a more or less extensive absorption; propyl alcohol, 290; isobutyl alcohol, 335; amyl alcohol, 332; allyl alcohol, 310. The presence of traces of the higher alcohols in ethyl alcohol can be detected by this means. In the case of the aromatic hydrocarbons, the absorption by benzene is represented by 290; toluene, 288; xylene, 310; *m*-xylene, 307; mesitylene, 336. The ultra-violet absorption very clearly distinguishes between the erbium and didymium groups of elements.

Exner's results are discussed and criticised.

K. J. P. O.

**Radioactivity and the Electron Theory.** By SIR WILLIAM CROOKES (*Proc. Roy. Soc.*, 1902, 69, 413—422).—That electrons (or "radiant matter") emanating from radioactive substances behave like material particles is shown by a series of experiments with actinium, radium, and polonium. The emanations from the last-named diffuse much less readily through air than do those from actinium and radium. The corpuscles from radium and actinium may be carried through a tube by a current of air, but this behaviour is not shown by the emanations from hydrogen peroxide.

J. C. P.

**Stratifications of Hydrogen.** By SIR WILLIAM CROOKES (*Proc. Roy. Soc.*, 1902, 69, 399—413).—When a tube provided with aluminium terminals and containing hydrogen is exhausted to 4 mm. by means of a mercury pump, the strata, or "buttons," observed on the passing of a discharge are blue on the convex side facing the negative pole, and pink on the other side. Spectroscopic examination shows strong hydrogen lines in the pink parts, and both hydrogen and mercury in the blue parts. When the exhaustion is raised to 2 mm., the blue is concentrated in one well-formed "button" nearest the negative pole, all the others remaining pink; on the blue "button," mercury alone can be detected, on the pink portions, hydrogen (chiefly) and mercury. At 1 mm., scarcely any hydrogen can be detected, the stratifications have almost disappeared, and mercury is strong all through the tube. Hydrogen strata showing no blue have been obtained by interposing between the vacuum tube and the mercury pump either (1) tubes containing copper, sulphur, and iodine, or (2) a glass spiral



immersed in ice-water. Occasionally, when no mercury was present, the author observed a faint blue edging on some of the pink strata; this was traced to an impurity in the phosphoric oxide used; this phosphoric blue, however, is much paler than the mercury blue. The blue colour of the strata in a tube containing both mercury and hydrogen may be eliminated also by introducing a water resistance, and thus altering the intensity of the spark.

It is very difficult to obtain stratification in mercury vapour, and the above observations show that the presence of hydrogen facilitates such stratification; the hydrogen strata probably act as obstructions in the same manner as a constriction in the tube or sealed-in wires. The pink and blue luminosities show where the electrons and gaseous atoms meet, the dense mercury atom not being driven back so much as the lighter hydrogen atom. J. C. P.

**Some Measurements with Gas Elements.** By EMIL BOSE (*Zeit. anorg. Chem.*, 1902, 30, 406—408. Compare Abstr., 1900, ii, 704; 1901, ii, 589).—A discussion of some points raised by Czepinski's paper (this vol., ii, 298). In particular, the author lays stress on his view that the hydrogen-oxygen cell is perfectly reversible.

J. C. P.

**Elements founded on the Reciprocal Action of Oxidising and Reducing Liquids. Common Solvents. Action of Acids and Bases.** By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1902, 134, 933—950. Compare following abstract).—In order to ascertain the mechanism of the production of free acid in animal secretions, the *E.M.F.* of various cells has been determined, and the same after the addition of an oxidising agent to one pole, of a reducing agent to the other pole, and of both additions simultaneously. The following concentration cells were examined: hydrochloric acid, sulphuric acid, lactic acid, oxalic acid, and formic acid. A reducing agent (pyrogallol) added to the liquid at the + pole hardly alters the *E.M.F.*, but when added to the liquid at the - pole the *E.M.F.* increases. An oxidising agent (hydrogen peroxide) at either pole increases the *E.M.F.* From the results obtained, it is concluded that acids are not favourable for the production of a sufficient *E.M.F.* to cause external electrolysis. Much better results are obtained with cells containing alkalis, of which the following were investigated: sodium hydroxide, sodium hydrogen carbonate, sodium formate, and ammonia. In these cases, pyrogallol, formaldehyde, and dextrose were used as reducing agents, and hydrogen peroxide as oxidiser. Using 0.2*N* sodium hydroxide and formaldehyde in the interior vessel, four elements suffice to electrolyse acidified water and to decompose an aqueous solution of sodium sulphate. Using different concentrations of sodium chloride, even addition of pyrogallol does not cause sufficient *E.M.F.* to produce electrolysis when 24 cells are employed. In neutralisation elements, the *E.M.F.* is greatly increased by the addition of a reducing or oxidising agent; this has been shown to be the case with elements constituted of: sodium hydroxide and sulphuric acid; sodium hydroxide and hydrochloric acid; sodium hydroxide and oxalic acid; sodium

hydroxide and acetic acid ; sodium hydroxide and lactic acid ; sodium hydroxide and nitric acid (the results in this case are analogous to the others, proving that the oxidising action of the nitric acid exerts scarcely any disturbing influence) ; sodium hydroxide and formic acid ; and ammonia and hydrochloric acid (in this case, pyrogallol produces a very great increase in the *E.M.F.*, but formaldehyde scarcely affects it). J. McC.

Elements founded on the Co-operation of a Reaction between Salts with the Reciprocal Action of Oxidising and Reducing Liquids. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1902, 134, 1009—1030. Compare preceding abstract).—The influence of the addition of oxidising and reducing agents on the *E.M.F.* of cells containing a free acid opposed to its normal salt has been investigated. With sodium sulphate and sulphuric acid, the voltage is increased by the addition of pyrogallol to the salt solution, and still further when hydrogen peroxide is simultaneously added to the acid. Hydrogen peroxide added to the acid alone diminishes the voltage. Addition of the same oxidising or reducing agent to both solutions causes an inversion of the poles and a decrease of *E.M.F.* on account of polarisation. Electrolysis can be carried out with 12 elements, containing pyrogallol in the salt solution and hydrogen peroxide in the acid. Similar results have been obtained with sodium oxalate and oxalic acid, lactates, acetates, chlorides, nitrates, formates, and also with ammonium chloride and hydrochloric acid.

Quite analogous results are obtained by the examination of cells containing sodium hydroxide opposed to sodium chloride, sulphate, nitrate, acetate, oxalate, lactate, or formate, and with ammonia opposed to ammonium chloride. The production of electrolysis is greatly favoured by the presence of alkali, and by the action of pyrogallol.

When pyrogallol is added to the sodium hydrogen carbonate of a cell containing this opposed to lactic acid, electrolysis can be carried out ; the voltage rises from 0.20 before the addition to 0.42 volt after the addition. By adding at the same time hydrogen peroxide to the acid, the *E.M.F.* rises to 0.58 volt. The effect of reducing agents (pyrogallol, formaldehyde, and dextrose) on the *E.M.F.* of this cell and others consisting of sodium hydrogen carbonate opposed to oxalic and formic acids and sodium formate opposed to lactic acid has been studied.

In the theoretical discussion, the author points out that the special conditions in a cell essential for external electrolysis depend on (1) the energy furnished in a given time by the chemical reactions taking place in the cell, and (2) the energy dissipated on external electrolysis and other outside circumstances. The energy furnished in a given time is determined by the velocity of the reactions, and this is conditioned by three factors: (1) purely chemical, (2) electrolytic, and (3) physical. These points are discussed in their bearing on the results just described, due account being taken of the conductivities. The reactions treated of are important in the electrolysis of organic compounds, and may be used to explain certain physiological changes.

J. McC.

Increase of Electrical Resistivity caused by Alloying Iron with various Elements, and the Specific Heat of those Elements. By W. FLETCHER BARRETT (*Proc. Roy. Soc.*, 1902, 69, 480—485).—When iron is alloyed with tungsten, cobalt, nickel, chromium, carbon, manganese, silicon, or aluminium, there is a decrease in conductivity, but this decrease has apparently no connection with the conductivity of the added element; thus aluminium, which is a much better conductor than nickel, has a far greater effect than the latter metal on the conductivity of iron. The author finds that the elements with the highest atomic weight produce the least increase in the resistance of iron. It is further shown that the order of magnitude of this increase is nearly the same as the order of the specific heats of the added elements. The order of thermal conductivity of the alloys has so far been found to be the same as the order of electrical conductivity. The order of magnetic permeability of the alloys is quite different from that of their electrical conductivity. The magnetic susceptibility of iron is increased by the addition of silicon and especially of aluminium, probably owing to the affinity of these elements for oxygen.

J. C. P.

Permeability of Animal Membranes. By G. GALEOTTI (*Zeit. physikal. Chem.*, 1902, 40, 481—497).—The resistance offered to the passage of an electric current in a specially constructed cell by 0.1*N* and 0.8*N* solutions of sodium chloride, sodium fluoride, potassium chloride, ammonium chloride, sodium sulphate, potassium oxalate, ammonium sulphate, calcium chloride, and magnesium sulphate was determined by the Kohlrausch method. The following animal membranes were then introduced on a silver ring into the cell, and the resistance again determined: intestine of sheep, pericardium of dog, mesentery of young dog, bladder of turtle, cæcum of dog, and intestine of holothurium. The membranes were used fresh, and after being killed by chloroform vapour. The intestine of sheep and the mesentery of dog are easily permeable by the ions, and the resistance is not much increased by the introduction of these into the cell. The pericardium of dog is easily permeable by the univalent ions of a binary electrolyte, but the bivalent ions do not pass through so easily. Introduction of the turtle bladder greatly increases the resistance, and the ions, therefore, do not pass through easily. The behaviour of the cæcum of dog and intestine of holothurium shows that the sodium ion passes through more easily when present with the chlorine ion than when with the fluorine ion; the chlorine ion permeates more easily when associated with the sodium ion than when with ammonium, calcium, or potassium ions;  $\text{SO}_4^{--}$  passes through more easily when derived from magnesium sulphate than when it is the product of dissociation of sodium or ammonium sulphate.

The permeability of the first three membranes mentioned is hardly affected by killing, and so these are to be regarded simply as diffusion membranes. The permeability of the other membranes is greatly increased by killing, so that the resistance observed with the dead membrane in the cell is almost the same as that without a membrane.

J. McC.

**Thermostats and Thermoregulators.** By WILLIAM C. GEER (*J. Physical Chem.*, 1902, 6, 85—105).—The author first briefly discusses the various forms of thermostats, namely, those dependent on the equilibrium of two different phases, and those dependent on mechanical regulators. The essentials of a good thermostat are (1) good insulation and low radiation constant; (2) delicate control of heat supply; (3) thorough stirring; (4) simple and sensitive regulation. He then describes a form of thermostat by which with ease constancy to  $0.005^{\circ}$  is obtained, and with care, a much higher constancy. The water-bath is heated by an electric current which passes through a lamp resistance, or may be short circuited. When the temperature falls, the current is short circuited, but when it rises it causes the closing of a relay circuit by which the lamp resistance is again thrown into the heating circuit. L. M. J.

**A Thermostat Sensitive to a Thousandth of a Degree.** By WALTER P. BRADLEY and A. W. BROWNE (*J. Physical Chem.*, 1902, 6, 118—135).—The thermostat was one employed in the determination of critical constants, and consists of two main parts, (1) the thermostat proper, and (2) the reservoir containing water kept at an approximately constant temperature a little above that of the thermostat. The water in this reservoir feeds the thermostat, but the supply is throttled by mercury, and if necessary cut off. The throttling is, however, preferable, as directly the cut off occurs the temperature becomes oscillatory, whereas when it is within the throttling range it is almost absolutely constant. L. M. J.

**Specific Heat of Substances at the Absolute Zero.** By A. PONSOT (*Compt. rend.*, 1902, 134, 703—705).—The author deduces by thermodynamical reasoning the following: (1) at absolute zero, the heat thermal capacity of a system is the sum of the thermal capacities of its elemental components in the solid state. (2) The specific heat of a saturated vapour is less than that of its solid or liquid, but both tend towards the same value at absolute zero (compare Behn, *Abstr.*, 1900, ii, 259). L. M. J.

**Boiling Point of Selenium and other Pyrometric Constants.** By DANIEL BERTHELOT (*Compt. rend.*, 1902, 134, 705—708).—The following values have been obtained by the author by means of an apparatus previously described (*Compt. rend.*, 1895, 120, 831; 1898, 126, 410). Boiling point of selenium,  $690^{\circ} + (h - 760)/10$ ; where  $h$  is the pressure in millimetres not far removed from the normal pressure; boiling point of cadmium,  $778^{\circ} + (h - 760)/9$ ; boiling point of zinc,  $918^{\circ} + (h - 760)/8$ ; melting point of silver,  $962^{\circ}$ ; melting point of gold,  $1064^{\circ}$ . L. M. J.

**Heats of Dissolution of Solid and Liquid Ammonia, and the Latent Heat of Fusion of Solid Ammonia.** By GUSTAVE MASSOL (*Compt. rend.*, 1902, 134, 653—655).—From the determinations of the heats of dissolution of solid and of liquid ammonia at temperatures very near to  $-75^{\circ}$ , the melting point of the solid, the author calculates



the latent heat of fusion. The values obtained for the molecular heat of dissolution in 100 molecules of water were: Liquid, +1.77 Cal.; solid, -0.068 Cal., from which the value 1.838 Cal. results for the molecular latent heat of fusion, a number not far removed from that of water, 1.43 Cal.

L. M. J.

**Thermal Equivalent of Dissociation and Vaporisation, the Heat of Solidification of Ammonia.** By ROBERT DE FORCRAND (*Compt. rend.*, 1902, 134, 708—711).—In the case of a solid dissociable compound of a gas, such as the compounds of ammonia with various metallic chlorides, the relation holds  $Q_1/T_1 = Q_2/T_2 = k$  (about 30), hence  $(Q_1 - Q_2) = k(T_1 - T_2)$ . The value  $(T_1 - T_2)/(Q_1 - Q_2)$  is what the author terms the thermal equivalent of the dissociation, and in the case of the compounds mentioned, although the values of  $(T_1 - T_2)$  vary from 17.9° to 212.5°, yet the mean of the above quotient is about 31.1°. For gaseous ammonia,  $Q/T = k$ , where  $Q$  is the total heat of solidification  $L + S$ . By this means, the value for  $L + S$  can be calculated, the result obtained being 7.695 Cal.

L. M. J.

**Latent Heat of Solidification of Liquid Ammonia.** By ROBERT DE FORCRAND and GUSTAVE MASSOL (*Compt. rend.*, 1902, 134, 743—745).—The mean value for the heat of dissolution of liquid ammonia obtained by different methods is 1.882 Cal.; this, with Massol's determination of the heat of dissolution of solid ammonia, -0.068 Cal., leads to the value 1.95 Cal. for the molecular heat of fusion of ammonia, and from this the value  $7.695 - 1.950 = 5.74$  Cal. for the molecular latent heat of vaporisation is obtained. The difference between this and the value for water is in accord with the generalisation of de Forcrand (preceding abstract).

L. M. J.

**The Relation  $(L + S)/T = Q/T_1 = k$ .** By ROBERT DE FORCRAND (*Compt. rend.*, 1902, 134, 768—770).—From observations on ammoniacal metallic chlorides, the author has previously deduced the value 7.695 Cal. for  $L + S$  in the case of ammonia. The value of  $S$  has been directly determined and is 1.95 Cal. The value of  $L$  may be calculated by Clapeyron's rule from Regnault's determinations of the vapour pressure of ammonia. The values thus obtained fall regularly from 5.73 at 240.5° to 5.22 at 323° absolute, the first value being that at the boiling point under 760 mm. The value  $L + S$  is hence  $5.73 + 1.95$  Cal., that is, 7.68 Cal., which is in good accord with the calculated value (7.695), and hence confirms the validity of the rule (this vol., ii, 60).

L. M. J.

**Relation between the Latent Heat of Evaporation and the Vapour Density.** By W. A. KURBATOFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 250—287).—The author describes a method for determining the latent heat of evaporation of compounds which readily solidify, a sketch of the apparatus used being also given. The total heat required to convert solid aniline hydrochloride into vapour is determined, and also the heat absorbed in melting the salt and heating it to the boiling point. These measurements having been made at various

pressures, the differences between the corresponding pairs of numbers give the latent heats of evaporation at the different pressures. The values of these latent heats are: Under 760 mm. pressure (b. p.  $244^{\circ}$ ), 252.0 Cal.; under 473 mm. (b. p.  $230^{\circ}$ ), 241.4 Cal.; under 394.6 mm. (b. p.  $225^{\circ}$ ), 252.7 Cal.; under 562 mm. (b. p.  $235^{\circ}$ ), 246.4 Cal.; under 442.1 mm. (b. p.  $227.9^{\circ}$ ), 242.6 Cal.

By means of the Clausius-Clapeyron formula, the amounts of dissociation at the boiling points under different pressures may be calculated, and in this way it is found that at its boiling point ( $244^{\circ}$ ) under 760 mm. pressure, aniline hydrochloride undergoes complete dissociation, whilst at a temperature  $15-20^{\circ}$  lower than this, about 10–15 per cent. of the salt remains undissociated in the state of vapour. There is no dissociation in the liquid salt.

The author shows that Trouton's law, namely,  $\rho M/T = \text{a constant}$  ( $\rho$  being the latent heat of evaporation,  $M$  the molecular weight, and  $T$  the absolute boiling point), can be derived from the Clausius-Clapeyron formula, and hence must not be regarded as a mere coincidence, but as a general law for all liquids. For a series of 98 organic and inorganic liquids for which data are available, the value of the above expression varies between 19.6 and 22.45, the mean number being about 21. Acetic, formic, butyric, and valeric acids, nitrogen peroxide, boron chloride, nitromethane, nitroethane, acetone, chloral hydrate, and chlorosulphonic acid are exceptions to this rule, as also are the following series of compounds: Water and the alcohols, which all give a constant somewhat greater ( $22.36-28.2$ ) than 21; the nitriles, for which the constant is low, ( $-19.5-19.97$ ); and amylamine, which is the only amine for which the data are known, and which gives a value 23.3.

The relation brought forward by Linebarger, namely,  $\rho M/T + 2 \log p = \text{a constant}$  (where  $\rho$  is the latent heat of evaporation,  $M$  the mol. weight,  $T$  the absolute boiling point at the pressure  $p$ ) is not upheld by the experimental data, the value of the expression varying to the extent of 12–15 per cent. for a liquid boiling under different pressures.

T. H. P.

Vapour Pressure in the System, Water-Acetone-Phenol. II. By FRANZ A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 1902, 40, 440–464. Compare this vol., ii, 243).—By plotting the results previously obtained at  $56.5^{\circ}$  on a system of coordinates, the composition of the mixtures which boil at this particular temperature and at a given pressure can be ascertained. For the pressure 300 mm., the results are graphically represented on a triangle. There are eight mixtures which boil under the given conditions ( $56.5^{\circ}$  and 300 mm.), and when the compositions of these are introduced into the diagram it is found that four of them lie on a straight line and are contained within the binodal curve. Any mixture the composition of which is represented on this line separates into two layers, the compositions of which are given by the points where the binodal curve cuts the line; they all boil at  $56.5^{\circ}$  under a pressure of 300 mm. The line made up of two curves and a straight part is the "vaporisation curve," and a corresponding "condensation curve" is introduced into the diagram. These

curves divide the triangle into three fields: a gaseous, a liquid, and a heterogeneous. As the pressure decreases, the vaporisation curve is so displaced that the liquid field becomes smaller and ultimately coincides with the side of the triangle representing water and phenol. Increase of pressure increases the liquid field, so that at 760 mm. (temperature  $56.5^{\circ}$ ) all the components, all binary, and all ternary mixtures must be liquid. The composition of mixtures which boil at  $56.5^{\circ}$  under various pressures is also given in a table.

The composition of the phases of a three-phase system consisting of two liquids and a vapour in equilibrium is represented in a triangular form, and this may be used to ascertain the distillation pressure and the composition of distillate and residue.

The vaporisation curves at temperatures  $50^{\circ}$ ,  $68^{\circ}$ , and  $75^{\circ}$  are given for various pressures. At  $50^{\circ}$ , the vapour pressure of the critical liquid is 305 mm. Another critical liquid has the vapour pressure 550 mm. at this same temperature, but this is made up from the system water-phenol. At  $75^{\circ}$ , the binodal curve lies wholly within the triangle, and within the liquid field at a pressure of 760 mm., therefore all two-layer systems can be realised at the ordinary atmospheric pressure. The vapour pressure of the critical liquid at this temperature is 685 mm., that of the other critical liquid being 310 mm. As the temperature rises, these two points approach each other and coincide at  $92^{\circ}$ ; the composition of the critical liquid must therefore be regarded as a function of the temperature.

The author also describes how the results may be represented on a space model; provided that the temperature is kept constant, the vapour pressure can be represented as a function of two variables depending on the composition.

J. McC.

**Calorimetric Determination of the Form of Pressure Melting Point Curves.** By ARSENIA WYCHESLAVTZEFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, ii, 41—46).—The author has devised a modification of the method introduced by de Visser (*Abstr.*, 1893, ii, 563) for determining calorimetrically the value of  $\Delta v/\Delta r$ , the ratio of the change of volume to the corresponding heat of fusion. Multiplying this number by the mechanical equivalent of heat and by the absolute melting point of the substance gives  $dt/dp$ , which determines the form of the melting point curve. In de Visser's method, the calorimeter is immersed in a bath of the substance to be examined, a large quantity of which is hence required. The author therefore uses a bath of ordinary machine oil provided with a stirrer and thermostat; a sketch of the apparatus is given.

In the following table are given the values of  $dt/dp$  found in this way by the author, together with those determined by direct measurement by various investigators:

	Calorimetric.	Direct.
Naphthalene .....	0.0355	0.0351 and 0.0361
<i>o</i> -Nitrophenol .....	0.0202	0.0232 „ 0.0191
Phenol .....	0.0146	0.0144
<i>o</i> -Cresol .....	0.0156	—
Trimethylcarbinol .....	0.0262	—

T. H. P.

**Method of Determining the Freezing Point of a Solution at Constant Temperature.** By K. PRYTZ (*Ann. Physik*, 1902, [iv], 7, 882—892).—The freezing point of an aqueous solution can be defined as that temperature at which ice and a solution may be brought together without producing either a rise or fall of temperature, and on this definition the author's method is based. A Dewar vacuum vessel is filled with broken ice, and in it is suspended a Beckmann thermometer surrounded with a spiral tube ending near the bottom of the vessel. The solution the freezing point of which is to be determined is well cooled, and then allowed to flow slowly through the spiral tube and up through the broken ice round the thermometer. The thermometer gradually falls and ultimately remains constant at the freezing point of the solution; this point is independent, within certain limits, of the rate of flow of the solution and of the external temperature. The author claims that the above procedure has several advantages over the usual method.

It is estimated that when the outer wall of a vacuum vessel such as that used by the author (6 cm. internal diameter) is  $1^{\circ}$  higher in temperature than the interior, each square centimetre of the inner wall receives 0.00006 gram cal. per minute. J. C. P.

**Cryoscopic Researches.** By PAUL D. CHRUSTCHOFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 153—182; 323—350. Compare Abstr., 1901, ii, 86 and 373).—The author has made use of the method previously described by him (*loc. cit.*), and here described in detail with the aid of sketches of the apparatus, to measure the depressions of freezing point of aqueous solutions of sodium and potassium chlorides, potassium bromide and sulphate, lead nitrate, sulphuric acid, and sucrose. From the results obtained, it is concluded that: (1) the method is sensitive and accurate; (2) the magnitude of the coefficient of depression (depression divided by concentration), and hence the mol. depression of freezing point, is not dependent on the dilution for all aqueous solutions. The way in which, in some cases, the mol. depression varies with the dilution is not in accord with the theory of dissociation as put forward by Arrhenius. T. H. P.

**Liquefaction of Gaseous Mixtures.** By F. CAUBET (*Zeit. physikal. Chem.*, 1902, 40, 257—367).—A brief history is first given of previous observations and discussions concerning critical phenomena, and a complete bibliography is added. The mixtures examined by the author were: (1) carbon dioxide and sulphur dioxide, (2) carbon dioxide and methyl chloride, (3) methyl chloride and sulphur dioxide. In the first system, eight separate mixtures were investigated, in which the concentration of the carbon dioxide varied from 0.10346 to 0.91095; the critical relations for the two pure gases are obtained from the observations of Cailletet and Mathias, and of Amagat. The relations between specific volume and temperature are first considered, the mixture containing 0.47103 of carbon dioxide being taken as an example. For this mixture at  $46.2^{\circ}$ , the specific volume of saturated vapour is 20.33 c.c., and of the liquid 1.318 c.c.; at  $56.8^{\circ}$ , the corresponding values are 14.101 and 1.499; at  $70^{\circ}$  they are 9.973 and 1.607. At  $86^{\circ}$ , the specific volume of the saturated vapour is



5.917, and when the volume decreases drops of liquid appear which increase until they possess the specific volume 2.223, when by a slight motion of the stirrer (an iron stirrer inside the tube and moved by an electro-magnet), the whole system becomes homogeneous. This is hence the critical temperature. At  $88^{\circ}$ , that is, above the critical temperature, liquid drops are formed when the specific volume reaches 5.4 c.c.; these increase until the quantity of liquid reaches a maximum, when they decrease and disappear at the specific volume 2.295. At  $92.8^{\circ}$ , drops of liquid appear, and disappear at the same specific volume, 3.7 c.c., so that this is the maximum temperature at which liquid can be formed, and between this and the critical temperature the system has no specific volume in the liquid state and two values of specific volume in the state of saturated vapour. Between these two temperatures, retrograde condensation is observed. The curves for all the mixtures are given, and from these the form of the critical line can be seen, although it is only clearly shown in a spatial projection in which a third axis of concentration is added. The curves representing pressure against temperature are next considered; at temperatures below the critical temperature, two important points are obtained—(1) the dew point, when liquid drops first form, and (2) the boiling point where the liquid phase alone exists. The values of these two points for the previous mixture are  $56.8^{\circ}$ , 29.6 and 69 atms.;  $70.4^{\circ}$ , 41 and  $82.4$  atms.;  $83^{\circ}$ , 57.2 and 92 atms. At  $86^{\circ}$ , the dew point is at 63.4 atms., and the critical point 93 atms. Above the critical temperature, no boiling point results, but two dew points with an intermediate pressure at which the liquid is a maximum. At  $91.4^{\circ}$ , these pressures are 76, 88,  $92.2$  atms. The critical line is hence the line at which the boiling point and dew point surfaces meet. The form of the isotherms is next considered; the course is that of a simple gas until the dew point is reached, when a discontinuity occurs, and the curve becomes less steep (ordinates = pressure); it, however, still slopes upward, in this respect differing from the isotherm of a single fluid, until the boiling point is reached, when the isotherm again becomes steeper. In the critical isotherm, however, there is no discontinuity at this second point, the isotherm being continuous from the two-phase to the one-phase system. Retrograde condensation is fully examined in those mixtures in which it is best observed, and tables of the volume of the liquid phase at different pressures between the two dew points are given for various temperatures. The author states that the appearance of the liquid is so different during retrograde condensation that it cannot be mistaken, the meniscus is flat, and the internal friction is far less than that of the liquid below the critical temperature, this being rendered very evident by the motion of the stirrer. At any given temperature and pressure, the composition of liquid and vapour in equilibrium is fixed, and as the dew point curve gives the values of the concentration of the vapour in equilibrium with liquid at various values of temperature and pressure, whilst the boiling point curve gives the composition of the liquid in equilibrium with vapour, the compositions of liquid and vapour in equilibrium with each other are readily obtained, and tables of these values are given. The specific volumes

are also calculated and shown by curves; at the critical temperature, the curves become continuous. The system methyl chloride and carbon dioxide was very similar, but in the case of the methyl chloride and sulphur dioxide system at certain concentrations the dew point and boiling point lines are tangential at certain points. These points are the points of Gibbs and Konowaloff. At such a point, therefore, there is no change of pressure during liquefaction, and the mixture at this temperature behaves like a single substance with a horizontal isotherm during the two-phase portion. In such a system, two equilibrium systems with double phase may occur at a given temperature and pressure; where this occurs, both phases in the one system must be more concentrated than the corresponding phases in the second. The paper concludes with a full account of the apparatus and experimental methods (Abstr., 1901, ii, 147, 148). L. M. J.

**Application of Optical Observations to the Study of Diffusion.** By J. THOVERT (*Compt. rend.*, 1902, 134, 594—596).—The paper contains the results of experiments obtained by the method previously described (this vol., ii, 197), and coefficients of diffusion are given for a number of salts and acids at various concentrations. The author states that the values for the salts are in good accord with those deduced according to Nernst's theory from electrolytic data, but in the case of acids the values are lower than those so calculated. L. M. J.

**Osmotic Properties of Colloidal Solutions.** By BENJAMIN MOORE and WILLIAM H. PARKER (*Amer. J. Physiol.*, 1902, 7, 261—293).—See this vol., ii, 413.

**Theory of the Velocity of Chemical Reactions.** By HANS EULER (*Zeit. physikal. Chem.*, 1902, 40, 498—503).—A reply to Wegscheider's objections (this vol., ii, 9) to the theory of ester hydrolysis already developed by the author (Abstr., 1901, ii, 532). If the constants,  $k$ ,  $\kappa$ , and  $K$  of the equations: (a)  $-d[\text{ester}]/dt = k[\text{ester}][\text{water}]$ ; (b)  $-d[\text{ester}]/dt = \kappa[\text{ester}][\text{HCl diss.}]$ ; and (c)  $-d[\text{ester}]/dt = [\text{ester}]\{[\text{water diss.}] + K[\text{HCl diss.}]\}$ , can be determined, the existence of an intermediary reaction must be assumed in order to explain the catalysis. J. McC.

**Decomposition of Mercurous Chloride by Dissolved Chlorides. A Contribution to our Knowledge of Concentrated Solutions.** By THEODORE W. RICHARDS and E. H. ARCHIBALD (*Zeit. physikal. Chem.*, 1902, 40, 385—398).—The action of concentrated solutions of sodium chloride on mercurous chloride and the disturbing effects caused by this in the Ostwald normal element were formerly noticed by Richards (Abstr., 1898, ii, 7), and it was suggested that the action might be a catalytic one. The amount of mercury salt found in solution when calomel is shaken with solutions of various concentrations of the chlorides of hydrogen, sodium, barium, and calcium, have been determined. The dissolved mercury exists wholly in the mercuric condition. The results are graphically represented, and from the curves it can be seen that as the concentration of the sodium chloride

increases, the quantity of dissolved mercuric chloride rises continuously ; with hydrochloric acid, a maximum solubility is reached when the acid is about  $7N$ , and at higher concentrations the amount dissolved remains practically constant. Calcium chloride also shows a maximum solvent power at about  $7N$ . The action of the dissolved chloride is not catalytic, and the extent to which it proceeds is a simple function of the square of the concentration of the chlorine ions. The results can be satisfactorily explained by assuming that a complex ion  $HgCl_4^{2-}$  is produced which is highly dissociated (compare Le Blanc and Noyes, *Abstr.*, 1890, 388).

The system is one with four components, namely, water, dissolved salt, mercury (formed by reduction), and mercuric chloride, and when, at a definite temperature, the four phases—mercury, mercuric chloride, solution, and vapour—are present, there is only one degree of freedom required to define the system ; this appears to be the concentration of the chlorine ions.

Similar reactions are effected by bromides and iodides, and, to a less extent, by sulphates.

Care must be taken, when precipitating mercury as mercurous chloride, to avoid the presence of much soluble chloride. J. McC.

**Decomposition of Organic Halogen Compounds by Sodium Amalgam in Alcoholic Solution.** By RICHARD LÖWENHERZ (*Zeit. physikal. Chem.*, 1902, 40, 399—439. Compare *Abstr.*, 1900, ii, 338 ; 1901, ii, 308).—The reaction between sodium amalgam and iodobenzene in alcoholic solution has been studied in detail ; experiments have also been made using *isobutyl* iodide, *isobutyl* bromide, and bromobenzene. The reaction is not so simple as when sodium alone is used and the value of  $k = 1/(Na) \cdot \log. a/(a-x)$  is not by any means constant ;  $(Na)$  is the quantity of dissolved sodium,  $a$  the original amount of halogen compound, and  $x$  the quantity decomposed. The quantity of water contained in the alcohol is without influence on the course of the reaction.

The results with iodobenzene show that the presence of dissolved sodium (as ethoxide) or of sodium iodide formed in the reaction has no effect on the value of  $k$ . The decomposition of iodobenzene by sodium amalgam is not directly proportional to the concentration of the iodobenzene ; as the concentration of the iodobenzene decreases from 0.4 gram-mol. to 0.0015 gram-mol., the value of  $k$  rises from 0.67 to 30.3. The influence of temperature on the decomposition is so small that it cannot be determined. No influence can be traced to the surface area of the amalgam. Similar results have been obtained with potassium and lithium amalgams.

The decomposition of bromobenzene by sodium amalgam takes place extremely irregularly, so that the value of  $k$  varies with circumstances and even in parallel experiments the same value cannot be obtained ; the influence of rapid stirring is particularly noticeable. The behaviour of *isobutyl* bromide is very similar to that of bromobenzene.

Chlorobenzene in alcoholic solution, when shaken with sodium amalgam, is only decomposed to the extent of about 1 per cent. One of the chlorine atoms of chloroform is easily removed by treatment

with sodium amalgam but further decomposition is exceedingly slow.

The author discusses the results of his investigation in connection with Kekulé's method of estimating halogen in organic compounds.

The difference in the reaction caused by sodium and that brought about by sodium amalgam is possibly due to secondary reactions taking place when amalgam is used. J. McC.

**The System Bismuth Oxide, Nitric Acid, and Water.** By G. M. RUTTEN (*Zeit. anorg. Chem.*, 1902, 30, 342—405).—Full details are given of work already described (Abstr., 1901, ii, 24). J. C. P.

**Method of Calculating Solubilities and the Equilibrium Constants of Chemical Reactions, and a Formula for the Latent Heats of Vaporisation.** By ALEXANDER FINDLAY (*Proc. Roy. Soc.*, 1902, 69, 471—478).—Ramsay and Young have shown (*Phil. Mag.*, 1886, [v], 21, 33) that if the complete vapour pressure curve of one substance and the vapour pressure of another substance at two temperatures are known, the vapour pressure curve of the second substance can be deduced from that of the first. The relation between the two vapour pressure curves may be expressed by the equation  $R = R' + c(t' - t)$ , and the author finds that a precisely similar equation connects the solubility curves of two substances; in this case,  $R$  and  $R'$  are the ratios of the absolute temperatures at which the substances have equal solubilities,  $c$  is a constant with a small positive or negative value,  $t'$  and  $t$  are the two temperatures at which the solubility of the second substance is known. The applicability of the equation has been tested with very satisfactory results on such pairs of substances as zinc chloride and bromide, potassium chloride and bromide, cadmium bromide and potassium nitrate, *m*- and *p*-hydroxybenzoic acids. The equation is independent of the state of ionisation of the dissolved substance, and of the sign of the heat of solution.

The temperature curves of the equilibrium constants of two reactions, even of quite different types, are related in a like manner, and an equation similar to the one quoted above is shown to apply satisfactorily to the reactions  $2\text{HI} \rightleftharpoons \text{H}_2 + \text{I}_2$  (Bodenstein, Abstr., 1899, ii, 637) and  $2\text{CH}_3\cdot\text{CO}\cdot\text{CH}_2 \rightleftharpoons \text{CH}_3\cdot\text{CO}\cdot\text{CH}_2\cdot\text{C}(\text{CH}_3)_2\cdot\text{OH}$  (Koelichen, Abstr., 1900, ii, 395).

The latent heat of vaporisation of a substance can be calculated, within a certain range, from the latent heat of vaporisation of another substance by means of the empirical equation  $L_1 = L_2 T_2^\alpha$ , where  $L_1$  is the latent heat of the first substance at the absolute temperature  $T_1$ ,  $L_2$  the latent heat of the second substance at  $T_2$ , at which the vapour pressure of the second substance is equal to that of the first substance at  $T_1$ , and  $\alpha$  is a constant. This relation holds very well in such cases as benzene and methyl acetate, or benzene and ethyl alcohol.

J. C. P.

**Catalysis of Hydroxylamine and Hydrazine.** By SIMEON TANATAR (*Zeit. physikal. Chem.*, 1902, 40, 475—480).—Berthelot's observation that hydroxylamine in alkaline solution decomposes according to the equation:  $3\text{NH}_3\text{O} = \text{NH}_3 + \text{N}_2 + 3\text{H}_2\text{O}$ , has been



confirmed. Another reaction, however, takes place simultaneously and the evolved gas contains about 5 per cent. of nitrous oxide. It may be assumed that this nitrous oxide is produced by oxidation of hydroxylamine by itself:  $4\text{NH}_3\text{O} = 2\text{NH}_3 + \text{N}_2\text{O} + 3\text{H}_2\text{O}$ . When platinum black is used as catalyser, the decomposition takes place rapidly and the evolved gas contains much nitrous oxide and only 11 to 17 per cent. of nitrogen. In neutral solution, the decomposition is slow. This is a case of a reaction in which the products differ when direct decomposition takes place and when a catalyser is used.

The author explains the catalysis by the theory proposed by Engler and Wöhler (this vol., ii, 127) according to which the platinum acts as an oxygen-carrier. The hydroxylamine oxidises the platinum and this oxide then oxidises another part of the hydroxylamine. The platinum oxide formed does not separate iodine from potassium iodide, and it is soluble in hydrochloric acid.

Hydrazine sulphate in aqueous solution is quickly decomposed in presence of platinum black and this does not favour the view expressed on the mechanism of the reaction, for hydrazine cannot directly oxidise platinum; the oxidation of the platinum may, however, take place at the expense of the water present:  $3\text{N}_2\text{H}_4 + 3\text{H}_2\text{O} = 6\text{NH}_3 + 3\text{O}$ ;  $3\text{N}_2\text{H}_4 + 3\text{O} = 3\text{H}_2\text{O} + 2\text{NH}_3 + 2\text{N}_2$ . Possibly the two catalyses are different.

J. McC.

**Inhibition of Chemical Reactions by Foreign Substances. I.**  
By STEWART W. YOUNG (*J. Amer. Chem. Soc.*, 1902, 24, 297—327).—It has been shown (Abstr., 1901, ii, 391) that the rate of oxidation of solutions of stannous chloride by means of oxygen is greatly diminished by the presence of small quantities of poisonous substances, especially alkaloids.

The rate of action of nitrous oxide and of nitric oxide on sodium sulphite is not appreciably affected by the presence of brucine, and it appears therefore that the inhibitory action is confined to reactions in which free oxygen is involved.

The effect of a number of substances on the rate of oxidation of sodium sulphite by oxygen has been investigated with the following results. The presence of brucine hydrochloride in a neutral solution causes a considerable retardation, but in alkaline solution its effect is much greater; in the latter case, the rate of oxidation is reduced to less than 0.01 of the normal rate by the presence of the brucine salt of a concentration 1/200,000 molar. In acid solutions, the influence of brucine is much less than in neutral solutions, and the period of development of the inhibitive action is longer. The effect of quinine hydrogen sulphate in neutral solution is considerably less than that of brucine hydrochloride, but in alkaline solution a concentration of 1/2600 molar is sufficient practically to stop the oxidation of the sodium sulphite. Morphine hydrochloride, atropine sulphate, sucrose, glycerol, potassium cyanide, ammonium chloride, sodium acetate, pyrogallol, *p*-hydroxybenzoic acid, hydroxylamine hydrochloride, and ethyl alcohol also have the power of inhibiting the oxidation of sodium sulphite, and in each case the effect produced is much greater in alkaline than in neutral solution. Determinations were made of the

velocity of oxidation in presence of each of these substances, and the results are tabulated.

A series of experiments was carried out with the object of determining the minimum concentration of certain substances necessary to produce a measurable inhibiting effect. The limit of dilution differs for different substances, the effect in some cases being still appreciable at a dilution of  $1/2,600,000$  molar.

The inhibitive effect has been shown in every case to be not instantaneous, but to develop slowly with the oxidation of the solution. In many cases, it was found that after the addition of the inhibiting agent an initial acceleration occurred.

E. G.

**Molecular Weight of Liquid Water, and Ostwald's Dilution Law.** By WILHELM VAUBEL (*Zeit. angew. Chem.*, 1902, 15, 395—398).—The author rehearses the grounds for his view that the molecule of liquid water is  $(H_2O)_6$ , and that electrolytic dissociation is conditioned by a combination of anion or cation with the molecular complex  $(H_2O)_5$ , or  $(H_2O)_6$ . Combining this hypothesis with the law of mass action, he deduces the form of the dilution law arrived at empirically by van't Hoff.

J. C. P.

**Molecular Weights of some Carbon Compounds in Concentrated Solutions with Carbon Compounds as Solvents.** By CLARENCE L. SPEYERS (*Amer. J. Sci.*, 1902, [iv], 13, 213—223. Compare Abstr., 1898, ii, 213; 1899, ii, 145; 1900, ii, 10).—By a slight modification of Walker's method (Abstr., 1899, ii, 6), the author has determined the molecular weights of non-volatile organic substances such as carbamide, resorcinol, acetanilide, naphthalene, acenaphthene, and benzamide in one or more of the following solvents: water, methyl, ethyl and propyl alcohols, and toluene; the solutions contained in some cases as much as 60 per cent. of dissolved substance. The molecular weight has been calculated by both the formulæ  $n/N = (p - p')/p'$  and  $n/N = l(p/p')$ , but the values obtained point rather to the superiority of the former.

The author deduces the equation  $l(n/N + 1) = Q'/R \cdot (T_1 - T_0)/T_1 T_0$ , where  $Q'$  is the heat of vaporisation of 1 gram-mol. of solvent from the solution (the quantity of solution being very large),  $R$  is the gas constant,  $T_1$  and  $T_0$  the boiling points of the solution and solvent respectively. This equation is independent of the osmotic theory and may be used to determine molecular weights according to the boiling point method, or to determine the heat of vaporisation of the solvent.

J. C. P.

**Researches on Physical Changes in the Condition of Colloids. I. Behaviour of Gelatin.** By WOLFGANG PAULI and PETER RONA (*Beitr. chem. Physiol. Path.*, 1902, 2, 1—41. Compare Pauli, Abstr., 1900, i, 265).—The influence of crystalloids on the behaviour of colloids is traced in the changes produced in the points of fusion and solidification of gelatin by the addition of various organic and inorganic substances. Ammonium sulphate and sodium acetate raise the points of fusion and solidification, whilst sodium and

ammonium chlorides have the opposite effect; variation of the percentage of gelatin leaves the relative influence of these salts unaltered, and for all concentrations of gelatin the influence of the cation is insignificant compared with that of the anion. The curve connecting the melting point of gelatin with the concentration of the latter is concave to the concentration axis, and this is the case also in the presence of any of the above-mentioned salts. The corresponding curves for the solidification point are practically straight lines, and from this difference in behaviour the authors conclude that gelatin about to melt is in a different condition from gelatin about to solidify, the temperature and concentration being the same.

The united effect of two crystalloids (in equivalent concentration) on the solidification and fusion of 10 per cent. gelatin is the algebraic sum of the individual effects. This result has been established with combinations of precipitating and non-precipitating salts, of electrolytes and non-electrolytes, and of non-electrolytes among themselves. The alteration of dissociation produced when two salts with a common ion are taken has apparently no effect on the solidification of gelatin.

The influence of crystalloids on the precipitation of gelatin from its solutions is entirely distinct from the influence exerted by them on the solidification and fusion points. Thus precipitation is effected only by electrolytes, whilst both electrolytes and non-electrolytes may help or hinder solidification. Again, salts which are alike in precipitating gelatin may have opposite effects on the solidification and fusion points. It has further been observed that dissociation of the salts is an important factor in the precipitation of gelatin. The precipitating power of salts is diminished by the addition of non-electrolytes, such as sucrose, dextrose, and especially carbamide. The author argues against Hardy's view that in the process of solidification of a gelatin solution two phases are formed, although this is doubtless the case in the precipitation of gelatin by electrolytes.

J. C. P.

Report of the [American] Committee on Atomic Weights. By FRANK W. CLARKE (*J. Amer. Chem. Soc.*, 1902, 24, 201—215).—A résumé of the work published during 1901 on the atomic weights of nitrogen, calcium, arsenic, antimony, tellurium, tungsten, uranium, lanthanum, praseodymium, neodymium, thorium, indium, yttrium, ytterbium, &c.; a corrected table of the atomic weights of all the elements is appended.

E. G.

The Theory of Partial Valencies. By EMIL ERLÉNMEYER, junr. (*J. pr. Chem.*, 1902, [ii], 65, 346—364).—A reply to Thiele (this vol., i, 151) and in part to Graebe (this vol., i, 209).

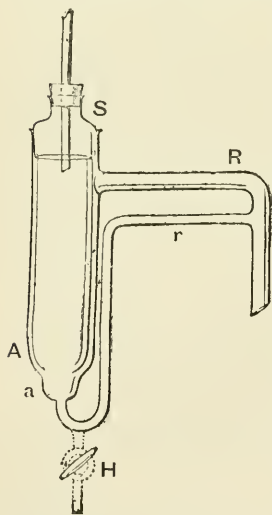
G. Y.

Modified Forms of an Adapter for Vacuum Distillation and of a Thermo-Regulator. By THOMAS S. PATTERSON (*J. Soc. Chem. Ind.*, 1902, 21, 456—457).—The adapter consists of a bulb-shaped flask, about 55 mm. in diameter. The neck is closed by a cork through which passes a narrow glass tube connecting the apparatus to the condenser. The portion of this tube inside the flask is bent towards the lower sides of the latter so that it will deliver the distillate into

one or other of three or more glass tubes sealed into the lower part of the flask, so that, by rotating the apparatus, the distillate may run into separate flasks connected to the tubes. A central tube at the bottom of the flask is placed in connection with the pump.

In the thermo-regulator described, the end of the mercury tube is closed by a cap of thin sheet india-rubber. Against this is placed the end of the gas supply tube, the latter being cut off at a very slight angle. The bulging of the india-rubber cap cuts off the supply of gas. The working temperature of the apparatus is set by means of a side tube on the mercury column, provided with a tap and small funnel through which mercury may be added or allowed to escape. The lower end of the mercury column is bent upwards and widens out into a bulb which may be filled with toluene or, possibly, air. W. P. S.

**Universal Extraction Apparatus for Solvents with High and Low Boiling Points.** By ANTON LANDSIEDL (*Chem. Zeit.*, 1902, 26, 274—275).—The apparatus consists of the extractor, *A*, the tube, *R*, which admits the vapour of the solvent and is connected with a distilling flask, and the tube, *r*, through which the extract runs back into the flask. The apparatus is attached to a reflux condenser by



means of the perforated cork, *S*. It may be used for the extraction of solids, or of liquids which are lighter than the solvent. Powders are either enclosed in a filter paper cartridge, or put as such into the extractor after having introduced at *a* a plug of glass or cotton-wool and also some solvent. The substance should on no account reach higher than the level of the horizontal part of the tube *r*. When a liquid has to be extracted, *a* is filled with solvent and the sample is poured on to the surface. The condensed solvent penetrates the liquid, collects at the bottom, and then runs back through *r* into the flask. The stopcock, *H*, serves for the purpose of collecting some of the solvent to see whether the extraction is complete, of allowing the solvent in the flask to be removed by distillation, and also of rapidly emptying the extractor. Two modifications of the apparatus are described in the paper.

In one of them (for solids only) the stopcock is absent, and the solvent, instead of continually flowing back into the flask, collects, and is then automatically removed by a syphon. The other serves for the extraction of liquids which are heavier than the solvent used.

L. DE K.

**Condensers and Reflux Condensers.** By ANTON LANDSIEDL (*Chem. Zeit.*, 1902, 26, 325—326).—The apparatus may be used for ordinary as well as fractional distillation and also serves as a reflux apparatus. It consists of the condenser, *A*, at the bottom of which is



sealed a wide and strong tube, *E*, which admits the vapours, of the worm, *B*, which further cools the condensed liquid, which then runs through *C* into a receiver, and of a jacket with a water inlet at *a* and outlet at *c*. During fractional distillations, the ground stopper from *E* is removed, and a thermometer inserted. When the apparatus is used as a reflux condenser, it is only necessary to close the stopcock near *B*; all but a few c.c. of the distillate runs back through *E* into the distilling flask.

A modification of the apparatus is also described.

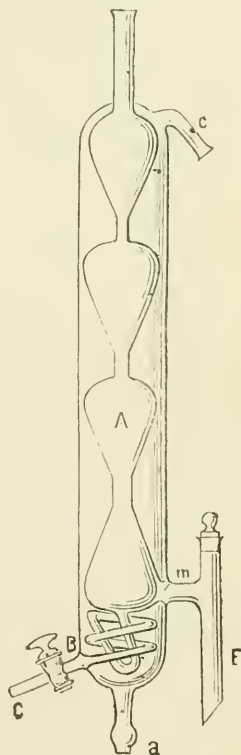
L. DE K.

**New Apparatus.** By CHARLES B. WILLIAMS (*J. Amer. Chem. Soc.*, 1902, 24, 246—248).—The author has devised (1) an instrument for marking volumetric flasks. (2) A bulb delivery tube for use in distilling ammonia in nitrogen estimations. The latter consists of an ordinary bulb delivery tube, the lower end of which is closed with the exception of a 2 mm. hole; 6 or 7 mm. above this end are four perforations arranged at equal distances round the tube, the object being to distribute the ammonia, and thus increase the facility for absorption by the acid. For details, the description and diagrams in the original must be consulted.

E. G.

**Some Lecture Experiments.** By F. BODROUX (*Bull. Soc. Chim.*, 1902, [iii], 27, 349—351).—The author describes several experiments to illustrate combination between solid substances. When water is dropped on a mixture of magnesium filings or zinc dust and iodine, violent reaction occurs, but the experiment is much more brilliant if a mixture of aluminium powder and iodine be employed. In this case, the mass inflames and the combustion propagates itself throughout the mass.

A. F.



## Inorganic Chemistry.

**The Question of Hydrogen in the Atmosphere.** By LORD RAYLEIGH (*Phil. Mag.*, 1902, [vi], 3, 416—422. Compare Gautier, *Abstr.*, 1900, ii, 538; Rayleigh, *Abstr.*, 1901, ii, 141).—From the

author's experiments it follows that the free hydrogen in country air does not exceed one part in 30,000 by volume. The method employed was to pass 10 litres of the dried air over heated copper oxide and absorb the water formed in a phosphoric oxide tube. J. C. P.

**Composition of Chlorine Hydrate.** By ROBERT DE FORCRAND (*Compt. rend.*, 1902, 134, 991—993).—From the heat of formation from ice and the heat of formation from liquid water, it is deduced that the formula of chlorine hydrate is  $\text{Cl}_2 \cdot 7\text{H}_2\text{O}$  (compare *Compt. rend.*, 1902, 134, 835). J. McC.

**Metallic Chlorates. Studies on the Solubility of Salts. X.** By ADOLPH MEUSSER (*Ber.*, 1902, 35, 1414—1424).—Measurements are given of the solubility of the chlorates of magnesium, zinc, cobalt, nickel, copper, and cadmium in water at different temperatures, as well as data with regard to the transformation points of their various hydrates. The following is a summary of the results. Hexa- and tetra-hydrates of the chlorates of zinc, magnesium, cobalt, and nickel can be obtained, and dihydrates of magnesium, zinc, cobalt, and nickel; in the case of cadmium chlorate, only the dihydrate is stable, and with copper chlorate only the tetrahydrate. In the case of the chlorates, 2 mols. of water are lost at a time, whilst with the analogous nitrates 3 mols. are lost; the solubility of the chlorates is much greater throughout than that of the nitrates. There appears to be no relationship between the order of solubility of the hexahydrates of the chlorates and nitrates of the same metals, but the order of solubility of the chlorates at low temperatures ( $-30^\circ$  to  $-20^\circ$ ) is that of the tension of their normal solutions. W. A. D.

**Behaviour of Hydrogen and Oxygen in Presence of Water.** By ARTURO MARCACCI (*Atti R. Accad. Lincei*, 1902, [v], 11, i, 324—326).—The author describes experiments which indicate that when hydrogen is left in a bell-jar over water, the gas is absorbed by the water and combines with the dissolved oxygen also present in the water. Confirmatory experiments are being made. T. H. P.

**New Method of Preparing Oxygen.** By GEORGE F. JAUBERT (*Compt. rend.*, 1902, 134, 778—779).—Pure oxygen is readily obtained by the action of water in a Kipp's or similar apparatus on compressed sodium peroxide, mixed before compression with the calculated quantity of a soluble permanganate or hypochlorite, or with traces of a nickel or cobalt salt. The peroxide,  $\text{KNaO}_3$ , obtained by the action of air on the liquid alloy of sodium and potassium, may be employed for the same purpose. C. H. B.

**Atomic Weight of Selenium.** By JULIUS MEYER (*Ber.*, 1902, 35, 1591—1593).—The percentage of silver in carefully purified silver selenite was determined by electrodeposition. The mean of five determinations by this method gave 79.21 as the atomic weight of selenium (compare Lenher, *Abstr.*, 1899, ii, 18). W. A. D.

**Compounds of Phosphorus and Selenium.** By JULIUS MEYER (*Zeit. anorg. Chem.*, 1902, 30, 258—264).—When selenium is dissolved in molten phosphorus, no compound is formed, but from the depression of the freezing point it is concluded that  $P_4Se$  and  $P_2Se$ , described by Hahn (*J. pr. Chem.*, 1864, 93, 430), do not exist. A mixture corresponding with the composition represented by  $P_4Se$ , when distilled in a current of carbon dioxide, gives pure phosphorus as distillate and selenium as residue. On heating a mixture of phosphorus and selenium in the mol. proportions 2:1, some phosphorus distils, then, at a higher temperature (360—400°), heavy, red vapours are formed which condense to oily drops, and these ultimately solidify. Analysis shows that this red substance has the composition  $P_4Se_3$ . It closely resembles  $P_4S_3$  in behaviour, and is very readily attacked by moisture.

Phosphorus, sulphur, and selenium, when fused in the proper proportions, give the compounds  $P_4S_3$ ,  $P_4S_2Se$ ,  $P_4SSe_2$ , and  $P_4Se_3$ . The melting point rises with the proportion of selenium, as the following values show:  $P_4S_3$ , 150—160°;  $P_4S_2Se$ , 190—200°;  $P_4SSe_2$ , 225—230°, and  $P_4Se_3$ , 300°.

On fusing a mixture of phosphorus and selenium in the mol. proportions 2:3, a substance is obtained which may be the compound  $P_2Se_3$ ; on distillation, it yields, first  $P_4Se_3$ , and at a red heat a dark substance passes over which, according to analysis, is  $P_2Se_5$ .

J. McC.

**Arsenic Oxide and its Hydrates.** By VICTOR AUGER (*Compt. rend.*, 1902, 134, 1059—1061).—A solution of arsenic acid, when heated at 63° for three days, gives a deposit of the hydrate  $H_6As_4O_{13}$ , which may be heated at 165° without altering, but at 175° loses water and is converted into the oxide. Fused arsenic oxide cannot be obtained pure, for below its melting point it gives off oxygen and leaves a residue containing arsenious oxide. The author concludes that the only hydrates known are  $H_8As_2O_9$  and  $H_6As_4O_{13}$ .

J. McC.

**Direct Combination of Chlorine and Carbon.** By WERNER VON BOLTON (*Zeit. Elektrochem.*, 1902, 8, 165—170).—When an electric arc is formed between carbon points in an atmosphere of carbon tetrachloride, the substance is rapidly decomposed into its elements. If, however, the arc is maintained in a small vessel (300 c.c.) in an atmosphere of chlorine which is not renewed, crystals are gradually deposited in the cooler parts of the vessel. These consist apparently of hexachlorobenzene. The yield is very small (0.02 gram in 6 hours with 42 volts and 5.5 amperes). With a larger vessel (2 litres capacity) divided into two parts by a constriction, large quantities of perchloroethane were formed. The arc was maintained in the upper chamber, and the lower one kept cold by means of a freezing mixture.

Similar results were obtained with bromine and iodine. They were not, however, followed up.

T. E.

**Classification and Atomic Weights of Neon, Argon, Krypton, and Xenon.** By HENRY WILDE (*Compt. rend.*, 1902, 134, 770—772).—

The author regards neon, argon, krypton, and xenon as belonging to the group of elements which includes nitrogen. In this group the atomic weight is represented by  $H \times 7n$ , and he takes the atomic weights to be respectively, 7, 21, 42, and 63. He assumes that the observed density of neon, 9.96, is too high in consequence of the difficulty of purifying it. C. H. B.

**Decomposition of Sodium Nitrate by Sulphuric Acid.** By C. W. VOLNEY (*J. Amer. Chem. Soc.*, 1902, 24, 222—226).—It has been shown previously (Abstr., 1901, ii, 600) that the decomposition of sodium nitrate by concentrated sulphuric acid takes place in two distinct phases. Further experiments have led to the following conclusions. At temperatures below  $20^\circ$ , neither strong sulphuric acid nor the compound  $\text{NaH}_3(\text{SO}_4)_2$  reacts with sodium nitrate; at a higher temperature, decomposition occurs, and the first phase is completed below  $100^\circ$ . The second phase, in which the compound  $\text{NaH}_3(\text{SO}_4)_2$  reacts with the sodium nitrate, takes place at temperatures above  $165^\circ$ . E. G.

**Redetermination of the Atomic Weight of Calcium.** By THEODORE W. RICHARDS (*J. Amer. Chem. Soc.*, 1902, 24, 374—377).—Two specimens of marble, one Italian, the other from Rutland, Vermont, U.S.A., were converted into calcium nitrate, which was carefully purified by recrystallisation. The nitrate was converted into the carbonate by precipitation with ammonium carbonate. The chloride was prepared from the carbonate, and was repeatedly recrystallised, ignited in a stream of hydrogen chloride and again recrystallised. Five analyses of three samples of calcium chloride, thus prepared, gave a mean value of 40.126 for the atomic weight of calcium ( $O = 16$ ,  $\text{Cl} = 35.455$ ) which agrees closely with that obtained by Hinrichsen (Abstr., this vol, ii, 137). E. G.

**Action of Hydrogen on Strontium Amalgam.** By ANTOINE GUNTZ (*Compt. rend.*, 1902, 134, 838—840. Compare this vol., ii, 138, 208).—The dissociation pressure of strontium hydride at  $1000^\circ$  is 100 mm., and at  $1100^\circ$ , 300 mm.; from these values, by the aid of Clapeyron's formula, the heat of formation of strontium hydride from its elements is found to be +38.4 Cal. The heat of formation has also been indirectly determined by observing the heat change when strontium hydride is decomposed by water into strontium hydroxide and hydrogen; it amounted to +54.75 Cal.; as the heat of formation of strontium hydroxide is +158.7 Cal., the heat of formation of strontium hydride is +34.7 Cal.

On heating strontium hydride at  $1300^\circ$  in a current of hydrogen, strontium is obtained as a white, crystalline metal. K. J. P. O.

**Solubility of Barium Sulphate in Ferric Chloride, Aluminium Chloride, and Magnesium Chloride.** By GEORGE S. FRAPS (*Amer. Chem. J.*, 1902, 27, 288—291).—The method employed was that of Fresenius and Hintz (Abstr., 1896, ii, 499), with the exception that



barium chloride was used in place of hydroxide. The following table shows the results obtained :

Concentration of "solvent" salt per litre, grams.	Milligrams (per litre) of BaSO <sub>4</sub> dissolved by		
	FeCl <sub>3</sub> .	Al <sub>2</sub> Cl <sub>6</sub> .	MgCl <sub>6</sub> .
1	58	33	30
2.5	72	43	30
5	115	60	33
10	123	94	33
25	150	116	50
50	160	170	50
100	170	175	50

The author also observed that, in presence of excess of barium chloride, barium sulphate is slightly less soluble in solutions of ferric and aluminium chlorides than in solutions of ammonium and sodium chlorides (2.5 per cent.) or in nitric and hydrochloric acids (2.5 per cent.).

T. A. H.

**Arsenides of the Metals of the Alkaline Earths.** By PAUL LEBEAU (*Ann. Chim. Phys.*, 1902, [vii], 25, 470—483).—An account of work already published (compare Abstr., 1899, ii, 288, 655).

G. T. M.

**Nature of Alkaline Solutions of Metallic Hydroxides.** By ARTHUR HANTZSCH (*Zeit. anorg. Chem.*, 1902, 30, 289—324).—By a study of (1) the conductivity of alkaline solutions of metallic hydroxides, (2) the rate at which these solutions saponify ethyl acetate, it is possible to estimate the extent of saponification of the salts formed by the combination of alkali and metallic hydroxide, and thence to deduce the relative strength of those hydroxides which appear to act as acids. The results, which are not quantitative in the strictest sense, have been arrived at by comparing the alkaline solutions of the hydroxides with solutions containing no hydroxide, but otherwise the same. The hydroxides of zinc, beryllium, lead, tin, and germanium all act as acids, the order given being the order of increasing strength. Of these, zinc and beryllium hydroxides are extremely weak acids; indeed, zinc hydroxide in alkaline solution appears to exist mostly in the colloidal form. Lead, tin, and germanium hydroxides have markedly acid properties, the last-mentioned being a weak electrolyte. All five hydroxides act as monobasic acids, and there is no ground for assuming the existence of such ions as ZnO<sub>2</sub><sup>2-</sup>. It is noted that the order of the hydroxides given above is not exactly the reverse of the order in which they would be arranged according to their strength as bases. Thus lead hydroxide as a base is stronger than beryllium hydroxide, and it might be expected that as an acid it would be weaker; this, however, is not the case. The key to the exceptionally marked acid character of the hydroxides of lead, tin, and germanium is found in the ability of these metals to act as quadrivalent elements; so that

the plumbites, for example, are salts of the acid,  $\text{Pb} \begin{smallmatrix} \text{H} \\ \diagup \\ \text{O} \\ \diagdown \\ \text{OH} \end{smallmatrix}$ ; rather than of the acid,  $\text{Pb} \begin{smallmatrix} \text{OH} \\ \diagup \\ \text{O} \\ \diagdown \\ \text{OH} \end{smallmatrix}$ , this internal constitutional change being accompanied by a strengthening of the acid character. From this point of view, the hydroxides of lead, tin, and germanium are acids of the  $\text{H} \cdot \text{CO}_2\text{H}$  type, their relative acid character corresponding with the position of these elements in the periodic system. J. C. P.

**Solubility of Hydroxides of the Heavy Metals in Sodium Hydroxide.** By JACOB RUBENBAUER (*Zeit. anorg. Chem.*, 1902, 30, 331—337).—The quantities of beryllium, zinc, tin, and lead hydroxides dissolved by sodium hydroxide solutions vary with the concentration of the latter; this influence of concentration is very marked in the case of zinc, slight in the case of lead, and still less in the case of beryllium and tin. For zinc and lead hydroxides, there is a maximum value of the solubility when the atomic ratios are  $\text{Zn} : \text{Na} = 1 : 3$  and  $\text{Pb} : \text{Na} = 1 : 14$  respectively; for tin there is a minimum at the ratio  $\text{Sn} : \text{Na} = 1 : 7.7$ ; for beryllium neither maximum nor minimum has been found, the solubility of the hydroxide slowly increasing with increasing concentration of the sodium hydroxide solution. The existence of a maximum or minimum may be attributed to two independent factors:—(1) hydrolysis of the zincates, &c., formed, the hydrolysis increasing as the solutions become more dilute, and leading to a diminished solubility; (2) dehydration of the hydroxides by strong alkali, and transformation into a less soluble form, this factor tending to a diminished solubility with increasing alkali concentration; thus undissolved stannous hydroxide, on treatment with cold concentrated alkali, is converted into anhydrous stannous oxide.

When zinc hydroxide is treated with alkali, more dissolves at first than corresponds with the true equilibrium under the prevailing conditions, for such solutions spontaneously deposit more or less zinc hydroxide according to the concentration: the same appears to hold for beryllium hydroxide, but not for tin and lead hydroxides (compare Herz, this vol., ii, 77; Kuriloff, this vol., ii, 139).

J. C. P.

**Interpretation of Certain Modifications of Metallic Hydroxides.** By ARTHUR HANTZSCH (*Zeit. anorg. Chem.*, 1902, 30, 338—341).—Zinc hydroxide separates from its alkaline solution (see Rubenbauer, preceding abstract) in the form of a fine, dense powder, soluble only with difficulty in sodium hydroxide. In referring to this and other cases involving similar changes of properties (compare Herz, Abstr., 1900, ii, 728; 1901, ii, 513; this vol., ii, 82), the author argues against the assumption of isomerism or polymerism, and attributes the phenomena in question (1) to physical alteration of the surface (see Ostwald, Abstr., 1900, ii, 712); (2) to a dehydration of the hydroxides caused by alkalis; an organic parallel of the latter process is found in the formation of an anhydride of quinonedioxime (Farmer and Hantzsch, Abstr., 1900, i, 103).

J. C. P.

**Alloys of Cadmium with Calcium and Barium.** By HENRI GAUTIER (*Compt. rend.*, 1902, 134, 1054—1056).—The alloys were prepared by heating a mixture of 175 grams of calcium iodide or 225 grams of barium iodide with 100 grams of cadmium and 50 grams of sodium to a red heat for two hours. The alloys so obtained contained 16 to 18 per cent. of alkaline earth metal; by distillation under reduced pressure, the percentage can be raised to about 45. The alloys rich in alkaline earth metal are decomposed by water; liquid bromine has no action on them, but they are attacked by bromine vapour or chlorine. Below a red heat, iodine has no action. They burn in oxygen or air. The action of sulphur is violent and sulphides are formed. Hydrogen and nitrogen give calcium or barium hydride or nitride under conditions which will be described later. J. McC.

**Analysis of an Antique Vase from Abou-Roach.** By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1902, [vii], 25, 467—470).—Analyses of a vase found in the mortuary chapel of the pyramid of King Didoufri, who lived at the commencement of the fourth dynasty, show that this article was originally produced by baking together a mixture of fine sand, litharge, and sodium chloride. The chief constituents of the material composing the vase are silica, lead, chloride, and oxide, together with smaller amounts of calcium carbonate, calcium and sodium oxides, and water. G. T. M.

**Radioactive Substances. Radioactive Lead.** By KARL A. HOFMANN and V. WÖLFL (*Ber.*, 1902, 35, 1453—1457. Compare this vol., ii, 261).—It is found that the radioactive material in lead can be most easily concentrated by dissolving the lead chloride in aqueous sodium thiosulphate; on being kept for some days, an extremely active black sulphide separates. It was compared with specimens of radium and polonium. Unlike polonium, radioactive lead acts on a photographic plate with great rapidity through an interposed sheet of gutta-percha. K. J. P. O.

**Thallous Sulphates.** By WILLEM STORTENBEKER (*Rec. Trav. Chim.*, 1902, 21, 87—94).—Thallous sulphate crystallises especially well in rhombic prisms from a solution containing a small quantity of free sulphuric acid; excess of the acid prevents crystallisation. The salt is far more soluble in dilute sulphuric acid than in water.

On concentrating a saturated solution of the normal sulphate, which contains for each mol. of sulphate 10 mols. of sulphuric acid, the *acid sulphate*,  $\text{Ti}_2\text{SO}_4 \cdot \text{TiHSO}_4$ , first separates in hexagonal leaflets; on further evaporation, *thallium hydrogen sulphate*,  $\text{TiHSO}_4$ , separates in four-sided, lustrous, monoclinic, hygroscopic plates melting at  $115\text{--}120^\circ$ , and also in rhombic needles.

The author finds that the method of estimating thallium as the hydrogen sulphate, recommended by Browning (*Abstr.*, 1900, ii, 247) is not satisfactory. It is better to estimate thallium as normal sulphate. K. J. P. O.

**Thallic Cæsium Sulphates.** By JAMES LOCKE (*Amer. Chem. J.*, 1902, 27, 280—284).—When solutions of thallic and

caesium sulphates are mixed in the quantities necessary for the formation of a caesium-thallium alum, there separates at first the hydrated double sulphate,  $\text{CsTl}(\text{SO}_4)_2 \cdot 3\text{H}_2\text{O}$ , which crystallises in colourless prisms of the rhombic system. The mother liquor, on concentration, deposits colourless, transparent plates of a second hydrated double sulphate,  $\text{CsTl}(\text{SO}_4)_2 \cdot 1\frac{1}{2}\text{H}_2\text{O}$ . The author has also attempted to prepare alums containing chromic in place of sulphuric acid by crystallising together aluminium chromate and caesium dichromate, but no evidence of the formation of such salts was obtained. When sulphuric acid is added to the crystallising solution, caesium aluminium alum separates.

T. A. H.

**Egyptian Metallic Tools.** By ALBERT COLSON (*Compt. rend.*, 1902, 134, 989—991).—The author describes a cold chisel dating from the Thébaines dynasty. It consists of two parts cemented together. The core contains 13·3 per cent. of tin and 84·6 per cent. of copper, and the envelope 4·7 per cent. of tin and 92·6 per cent. of copper.

J. McC.

**Cerium Peroxide.** By E. BAUR (*Zeit. anorg. Chem.*, 1902, 30, 251—257).—Cerous sulphate solution containing potassium carbonate, when shaken with air, is converted into cerium peroxide, and at the same time some ceric salt is formed. A slight alkalinity of the solution increases the yield of peroxide. When arsenious oxide is used as "acceptor," the cerium is converted to a greater extent into peroxide.

By the method employed by Manchot and Wilhelms (*Abstr.*, 1901, ii, 658), the influence of cerium on the reaction between potassium iodide and hydrogen peroxide has been investigated. In neutral solution, cerous salts cause a separation of iodine, amounting to about two-thirds of an equivalent per equivalent of cerium; the action is, however, complicated by the fact that the ceric hydroxide formed has a catalytic influence which increases the amount of iodine separated, and, on the other hand, this is decreased, because the peroxide acts directly on the cerous oxide. The results are in agreement with the assumption that an intermediate product is formed, but they do not prove this.

The salt,  $\text{Ce}_2\text{O}(\text{CO}_3)_2 \cdot \text{O}_3 \cdot 4\text{K}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ , described by Job (*Abstr.*, 1899, ii, 486), gives oxygen as well as carbon dioxide when treated with dilute sulphuric acid. More oxygen is liberated than indicated by the equation  $2\text{CeO}_3 + 3\text{H}_2\text{SO}_4 = \text{Ce}_2(\text{SO}_4)_3 + \text{O}_2 + \text{H}_2\text{O}_2 + 2\text{H}_2\text{O}$ , and this is due to a spontaneous decomposition of the hydrogen peroxide present.

J. McC.

**Solubility of Zinc Hydroxide in Ammonia and Ammonium Bases.** By W. HERZ (*Zeit. anorg. Chem.*, 1902, 30, 280—281).—The solubility of precipitated zinc hydroxide, dried at 60—70°, in solutions of ammonia and amines of various concentrations has been determined at the ordinary temperature (17—19°). It is insoluble in dimethylamine and diethylamine. From the results with ammonia, methylamine, and ethylamine, it is found that the more dilute the solution of the base the more molecules are required to dissolve the hydroxide. Substitution of a hydrogen atom of ammonia by an



alkyl group decreases the solubility, the depression increasing with the mol. weight of the substituting group. J. McC.

**Cerium Oxycarbide.** By JEAN STERBA (*Compt. rend.*, 1902, 134, 1056—1059).—Cerium oxide, when heated in the electric furnace for one minute with a quantity of carbon (soot) insufficient for complete reduction and the product washed with ice water, gives a brown residue of the compound  $\text{CeC}_2, 2\text{CeO}_2$ . The sp. gr. at  $17^\circ$  is 4.8. It is stable in the air, and is only slowly attacked by cold water. With hot water or acids, it gives unsaturated hydrocarbons. It burns in the air with incandescence. It is acted on by fluorine at  $150^\circ$ , by chlorine, bromine, and iodine at a dull red heat, by hydrochloric, hydrobromic, and hydriodic acids at a red heat, and by sulphur at  $450^\circ$ . When fused in the electric furnace, it gives the carbide  $\text{CeC}_2$ . J. McC.

**Dextrose and Cerium Carbonates.** A New Means of Induced Oxidation. By ANDRÉ JOB (*Compt. rend.*, 1902, 134, 1052—1054. Compare Abstr., 1901, ii, 657).—Ceric carbonate, when shaken with air, gives cerium peroxide which can be recognised by its colour. If a solution of potassium arsenite be added, the red colour of the peroxide develops, but rapidly disappears when the agitation is stopped.

A concentrated solution of dextrose quickly reduces cerium peroxide. An alkaline solution of ceric carbonate is not oxidised by the air, but if dextrose be added cerium peroxide is produced. The dextrose induces the peroxidation of the cerium. Ceric carbonate does not oxidise potassium arsenite, but in presence of dextrose the arsenite is converted into arsenate. J. McC.

**Alloys of Aluminium.** By WILLIAM CAMPBELL and JOHN A. MATHEWS (*J. Amer. Chem. Soc.*, 1902, 24, 253—266).—The authors have studied the alloys of aluminium with lead, bismuth, cadmium, platinum, tungsten, nickel, tin, antimony, and copper.

The addition of 5—10 per cent. of platinum to aluminium causes no change of colour, but alloys containing 30—50 per cent. of platinum are distinctly yellow. By dissolving away the excess of aluminium, long, needle-shaped crystals are obtained of the composition  $\text{AlPt}_4$ .

From alloys containing 3—17 per cent. of tungsten, thin, monoclinic crystals of the composition  $\text{WAl}_5$  were obtained, and in one case hexagonal crystals of the composition  $\text{WAl}_7$  were isolated.

The addition of tin to aluminium causes a gradual depression of the freezing point to  $570^\circ$  when the alloy contains 74 per cent. of tin; a sudden fall then occurs to  $490^\circ$  with 80 per cent. of tin; from this point, the freezing point rises to  $550^\circ$  with 85 per cent. of tin, and then falls regularly to the eutectic point,  $229^\circ$ , when 99.52 per cent. of tin is present.

The paper is illustrated with diagrams and microphotographs.

E. G.

**Barium Aluminate employed as a Disencrusting Agent.** By GEORGES ARTH (*Bull. Soc. Chim.*, 1902, [iii], 27, 297—302).—For the

removal of calcium sulphate from boiler water on the commercial scale, the author finds that a quantity of barium aluminate less than is required by the equation  $\text{BaAl}_2\text{O}_4 + \text{CaSO}_4 = \text{BaSO}_4 + \text{CaAl}_2\text{O}_4$ , is sufficient to precipitate the sulphate; the resulting liquid, however, is not entirely free from dissolved salts, and is always found to contain lime in solution.

A. F.

**Compounds of Alumina and Chromium Sesquioxide.** By ANDRÉ DUBOIN (*Compt. rend.*, 1902, 134, 840—842).—Compounds of alumina with chromium sesquioxide present in a mixture of alumina and chromium sesquioxide can be analysed by fusing the mixture with potassium chlorate, which dissolves only the uncombined chromium sesquioxide. The analyses point to the existence of a compound,  $\text{Cr}_2\text{O}_3 \cdot 8\text{Al}_2\text{O}_3$ . The colour of the mixed oxides depends on the state of the alumina used. With calcined alumina, a much smaller proportion of chromium sesquioxide changes the original rose colour to green than when gelatinous alumina is used.

K. J. P. O.

**Crystallisation of Iron.** By FLORIS OSMOND and G. CARTAUD (*Chem. Centr.*, 1902, i, 848; from *Ann. Mines*, 17, 110—150; 18, 113—153).—When iron is heated from the ordinary temperature to its melting point, it undergoes two changes; the one taking place gradually between  $700^\circ$  and  $760^\circ$  and corresponding with the disappearance of the magnetic properties, the other occurring suddenly at  $860^\circ$ . Since the metal on solidification usually forms  $\gamma$ -iron, the octahedral crystals must belong to this form, although their internal structure corresponds with the  $\alpha$ -form, which is stable at the ordinary temperature. The crystalline form of  $\alpha$ - and  $\beta$ -iron can only be inferred from the appearance of the etched surfaces, and these show a cubical structure. Pure iron prepared at temperatures up to about  $800^\circ$  by reducing ferrous chloride with hydrogen usually separates in small hexahedra, but sometimes in tetrakis-hexahedra and rhombic dodecahedra. The hexahedra interpenetrate one another in the crystalline skeletons and crusts in the most various ways, but are always parallel. At temperatures from  $800$ — $1000^\circ$ , pure iron was prepared by reducing ferrous chloride with zinc vapour, usually in an atmosphere of nitrogen. The metal separated in hexahedra, often combined with octahedra and twinned on an octahedron face. The crystalline crusts obtained at these temperatures showed octahedral edges (twinning?), and their structure resembled that of the technically prepared  $\gamma$ -iron.

E. W. W.

**The Density of Aqueous Solutions of Ferrous Chloride.** By JOHN T. DUNN (*J. Soc. Chem. Ind.*, 1902, 21, 390).—The table on p. 401 is given, showing the amounts of ferrous chloride contained in solutions of various specific gravities.

Columns are also given showing the weights of ferrous chloride in 100 grams of solution and of the amounts of the crystallised salt ( $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$ ) contained in 100 c.c. and 100 grams of the solution. A second table gives similar information for solutions having sp. gr.

Specific gravity at 15.5°.	Grams of FeCl <sub>2</sub> in 100 c.c.	Specific gravity at 15.5°.	Grams of FeCl <sub>2</sub> in 100 c.c.
1.0459	5.19	1.2916	34.92
1.0892	10.27	1.3010	36.38
1.1255	14.64	1.3289	39.80
1.1385	16.08	1.3674	44.65
1.1688	19.73	1.4065	49.39
1.2103	24.95	1.4319	52.80
1.2528	30.16	1.4439	54.20
1.2625	31.55		

between 1.05 and 1.44, with a difference in their gravities of 0.01.

W. P. S.

**Germanium Hydride.** By E. VOEGELEN (*Zeit. anorg. Chem.*, 1902, 30, 325—330).—If germanium chloride is reduced with sodium amalgam, the hydrogen evolved, even when bubbled through sodium hydroxide solution, burns with a bluish-red flame, and deposits a mirror on a cold porcelain surface. Germanium hydride, to which this phenomenon is attributed, may be prepared also in Marsh's apparatus like antimony and arsenic hydrides; the mirror obtained by heating the tube through which the issuing gas passes is red in transmitted, green in reflected, light; it is soluble in sodium hypochlorite, difficultly so in hot hydrochloric acid; heating in air or with concentrated nitric acid changes the mirror into white germanic oxide, which, when acted on with hydrogen sulphide in hydrochloric acid solution, gives a white precipitate of germanium sulphide soluble in ammonium sulphide. When germanium hydride is passed through silver nitrate solution, a black compound of germanium and silver is precipitated; this, when treated with concentrated nitric acid, leaves a white residue of germanic oxide. The author has attempted to decide whether the formula of the hydride is  $\text{GeH}_2$ ,  $(\text{Ge}_2\text{H}_4)$ , or  $\text{GeH}_4$  by (1) analysing the germanium silver compound, (2) passing the germanium hydride over finely divided sulphur in a strong light, and comparing the amounts of germanium and hydrogen sulphides formed. The results, owing to the small quantity of material available, are not very consistent, but point to  $\text{GeH}_4$  as the formula of germanium hydride; this agrees with the formula of the tetraethyl derivative  $\text{GeEt}_4$ , prepared by Winkler (compare Winkler, *Abstr.*, 1886, 985; 1887, 1081).

Attempts to prepare tin hydride were unsuccessful, and in view of this the author characterises germanium as a non-metal. J. C. P.

**Sulphates of Bismuth.** By F. B. ALLAN (*Amer. Chem. J.*, 1902, 27, 284—288).—When acid bismuth sulphate,  $\text{Bi}_2\text{O}_3 \cdot 4\text{SO}_3$ , (Adie, *Proc.*, 1899, 15, 226) is stirred with sulphuric acid of various concentrations until equilibrium occurs, the solid phase consists of this salt alone so long as the liquid phase contains from 60 to 90 per cent. of sulphuric acid; when this falls below 47.5 per cent., the separated solid consists of the salt  $\text{Bi}_2\text{O}_3 \cdot 2\text{SO}_3$ , and the latter is stable until the concentration of the acid falls to 1.37; below this point, the solid phase is a mixture of the two salts  $\text{Bi}_2\text{O}_3 \cdot \text{SO}_3$  and  $\text{Bi}_2\text{O}_3 \cdot 2\text{SO}_3$ , until

the acid is reduced to 1.09 per cent., when  $\text{Bi}_2\text{O}_3 \cdot \text{SO}_3$  remains, being stable in presence of water alone. No indication at any stage of the existence of the salt  $5\text{Bi}_2\text{O}_3 \cdot 11\text{SO}_3 \cdot 17\text{H}_2\text{O}$  was observed.

T. A. H.

**Preparation and Properties of Lead Chloro-, Bromo-, and Iodo-thiobismuthites.** By FERNAND DUCATTE (*Compt. rend.*, 1902, 134, 1061—1063).—*Lead chlorothiobismuthite* ( $\text{PbS} \cdot \text{Bi}_2\text{S}_3 \cdot 2\text{BiSCl}$ ) is produced by heating a mixture of equal parts of lead chloride and bismuth sulphide to the fusion point in a current of carbon dioxide. It is obtained in long crystals of sp. gr. 6.42, which are quite stable in the air and insoluble in water. It oxidises at a red heat and is decomposed by boiling water. With acid, it gives hydrogen sulphide. The corresponding *bromothiobismuthite* (sp. gr. 6.50) and *iodothiobismuthite* (sp. gr. 6.59) are obtained in the same way and closely resemble in appearance and properties the chlorothiobismuthite.

J. McC.

**Action of Selenic Acid on Gold.** By VICTOR LENHER (*J. Amer. Chem. Soc.*, 1902, 24, 354—355).—When gold is treated with hot concentrated selenic acid, it dissolves with liberation of selenium dioxide and formation of a reddish-yellow solution of *auric selenate*,  $\text{Au}_2(\text{SeO}_4)_3$ ; the action begins at about  $230^\circ$ , but proceeds more readily at  $300^\circ$ . The selenate forms small, yellow crystals; it is insoluble in water but soluble in sulphuric, nitric, or hot selenic acid. By the action of hydrochloric acid on it, chlorine is evolved and auric chloride and selenious acid are produced. It is decomposed by heat with production of metallic gold. On exposure to light, it becomes dark green and afterwards bronze-coloured.

E. G.

**Naturally Occurring Telluride of Gold.** By VICTOR LENHER (*J. Amer. Chem. Soc.*, 1902, 24, 355—360).—When a solution of auric chloride is added to tellurium, gold is deposited and tellurium tetrachloride is produced.  $4\text{AuCl}_3 + 3\text{Te} = 4\text{Au} + 3\text{TeCl}_4$ . A similar reaction takes place with solutions of silver salts. Selenium also causes the precipitation of gold from solutions of its salts. The natural tellurides (calaverite, sylvanite, coloradoite, kalgoorlite, and nagyagite) behave like tellurium itself in precipitating gold from a solution of auric chloride.

Attempts to prepare gold telluride artificially were unsuccessful. The experiments of Brauner (*Trans.*, 1889, 55, 391) on the synthesis of gold telluride were repeated. The product obtained by heating gold with tellurium in an atmosphere of carbon dioxide is of inconstant composition and reduces auric chloride. If hydrogen telluride is led into a solution of auric chloride, gold is precipitated.

It has been shown (this vol., ii, 316) that when tellurium is treated with sulphur monochloride, tellurium tetrachloride is produced; the natural tellurides behave in a similar manner, gold being left as a residue.

These facts seem to indicate that the natural tellurides are not to be regarded as true chemical compounds.

F. G.



## Mineralogical Chemistry.

The Cerargyrite Group (Holohedral-cubic Silver Haloids). By GEORGE T. PRIOR and LEONARD J. SPENCER) *Min. Mag.*, 1902, 13, 174—185).—The results of the qualitative examination of twenty-eight specimens, from various localities, and the following quantitative analyses indicate that chlorargyrite, embolite, bromargyrite and iodobromite cannot be sharply divided into species as is done in modern text-books, but that they pass indefinitely into each other and form an isomorphous group the general composition of which is represented by the formula  $\text{Ag}(\text{Cl}, \text{Br}, \text{I})$ . There is no definite mineral with the composition,  $2\text{AgCl}, 2\text{AgBr}, \text{AgI}$ , to which the name iodobromite was given; for cerargyrites containing all three halogens in variable proportions, the name *iodembolite* is proposed, but in these the iodine cannot exceed the amount given by the ratio  $\text{Cl}:\text{Br}:\text{I}=1:1:1$ . Analysis I is of orange-yellow cubo-octahedra of iodembolite from Chañarcillo, Chili; II, III, and IV are of material of which the colour is orange-yellow, greenish-yellow and pale greenish-grey respectively, from Broken Hill, New South Wales.

	Ag.	Cl.	Br.	I.	Total.	Sp. gr.	Approximate formula.
I.	60·37	7·11	22·35	10·39	100·22	6·17	$5\text{AgCl}, 7\text{AgBr}, 2\text{AgI}$
II.	56·93	1·96	32·22	8·77	99·88	6·31	$5\text{AgCl}, 40\text{AgBr}, 7\text{AgI}$
III.	67·28	14·36	15·85	2·35	99·84	5·82	$20\text{AgCl}, 10\text{AgBr}, \text{AgI}$
IV.	66·91	13·20	19·71	0·16	99·98	5·66	$3\text{AgCl}, 2\text{AgBr}$

The general characters of the group are summarised as follows: Holohedral-cubic; common forms, the cube and octahedron; twinning, on an octahedral plane, rare. Cleavage, none; fracture, uneven to sub-conchoidal. Tough and sectile;  $\text{H}=2\frac{1}{2}$ . Sp. gr. variable, depending on chemical composition (the pure chloride has the sp. gr. 5·556). Lustre vitreous to resinous; translucent. The colour also varies with the composition, being grey or colourless in the pure chloride, greenish-grey in the pure bromide and chlorobromides, and greenish-yellow to orange-yellow when all three halogens are present.

The results of this and a previous paper (Abstr., 1901, ii, 394) show that silver iodide may crystallise under one or other of the following four conditions. At temperatures below  $146^\circ$  (assuming atmospheric pressure), the pure iodide crystallises as hemimorphic-rhombohedral iodyrite, whilst above this temperature tetrahedral-cubic crystals are formed; it may also enter, to a certain extent, into isomorphous mixture with holohedral-cubic silver chloride and bromide (cerargyrite); or, again, may form tetrahedral-cubic crystals of the double salt  $4\text{AgI}, \text{CuI}$  (miersite).

L. J. S.

Baumhauerite, a New Mineral; and Dufrenoy'site. By RICHARD H. SOLLY, with an analysis by HENRY JACKSON (*Min. Mag.*, 1902, 13, 151—171).—The new mineral, *baumhauerite*, closely resembles in appearance the other sulpharsenites of lead which occur in

the crystalline dolomite of the Binnenthal in Switzerland. The crystals are monoclinic with numerous forms, and there is a perfect cleavage parallel to the orthopinacoid. The streak is chocolate coloured. Sp. gr. 5.330. Analysis gave :

Pb.	Sb.	S.	Total.
48.86	24.39	26.42	99.67

These numbers agree with those required for the formula  $4\text{PbS}, 3\text{As}_2\text{S}_3$ , which has previously been assigned to liveingite (Abstr., 1901, ii, 558), but it is now pointed out that the analysis of liveingite agrees more closely with the formula  $5\text{PbS}, 4\text{As}_2\text{S}_3$ .

A detailed crystallographic examination of dufrenoysite ( $2\text{PbS}, \text{As}_2\text{S}_3$ ), also from the Binnenthal dolomite, shows that this mineral crystallises in the monoclinic system and not in the rhombic as previously asserted.

L. J. S.

**Identity of Kilbrickenite with Geocronite: Analyses of Miersite, Marshite, and Copper-pyrites.** By GEORGE T. PRIOR (*Min. Mag.*, 1902, 13, 186—190).—Kilbrickenite, from the Kilbricken Mine in County Clare, has usually been considered to be a distinct mineral species with the formula  $6\text{PbS}, \text{Sb}_2\text{S}_3$ , but a study of the literature suggests its identity with geocronite. A new analysis of the original massive material gave the results under I, agreeing with the formula  $5\text{PbS}, \text{Sb}_2\text{S}_3 + 5\text{PbS}, \text{As}_2\text{S}_3$ , which represents a double salt as recently suggested for geocronite (this vol., ii, 211):

	Pb.	Sb.	As.	S.	Total.	Sp. gr.
I.	68.49	9.13	4.59	17.20	99.41	6.45

Miersite and marshite (Abstr., 1901, ii, 394), from Broken Hill, New South Wales, now analysed for the first time, gave the results under II and III, agreeing with the formulæ  $4\text{AgI}, \text{CuI}$  and  $\text{CuI}$  respectively :

	Ag.	Cu.	I.	Total.	Sp. gr.
II.	38.17	5.64	56.58	100.39	5.640
III.	1.19	32.35	65.85	99.39	5.590

Copper-pyrites from Wheal Towan, St. Agnes, Cornwall, gave the results under IV agreeing with the usual formula  $\text{CuFeS}_2$ . The crystals were analysed on account of their unusual habit, being of pseudo-cubic symmetry as the result of twinning, and in this respect resembling the crystals of stannite recently described (Abstr., 1901, ii, 392).

	Cu.	Fe.	S.	Total.	Sp. gr.
IV.	33.60	30.92	34.90	99.42	4.17

L. J. S.

**Crystalline Development of Calaverite.** By G. F. HERBERT SMITH, with analyses by GEORGE T. PRIOR (*Min. Mag.*, 1902, 13, 122—150).—A detailed crystallographic description is given of calaverite from Cripple Creek, Colorado. The morphological development of the faces is in complete agreement with monoclinic symmetry, but when the crystals are referred to this system, as is done by

Penfield and Ford (this vol., ii, 28), the indices are exceedingly complex. The faces, although lying in zones, cannot be referred to a single space-lattice, and, in fact, there appear to be in all five distinct lattices, which are incongruent but not independent, the prism-zone being common to all. The principal and also the second lattices have triclinic symmetry, and a third is monoclinic. The intermingling of material of different structures indicates that the crystals are not homogeneous, and this heterogeneity is further suggested by certain crystallographic relations of calaverite to sylvanite and krennerite when considered in connection with the absence of cleavage and the extreme brittleness of the calaverite crystals. Four types of twinned crystals are described.

The following analyses, made on crystals, agree approximately with the formula  $\text{AuTe}_2$ :

	Au.	Ag.	Te.	Total.	Sp. gr.
I.	41·66	0·77	57·87	100·30	} 9·155
II.	41·90	0·79	56·93	99·62	

L. J. S.

**Gahnite from Färila, Sweden.** By HERMAN HEDSTRÖM (*Jahrb Min.*, 1902, i, Ref. 165; from *Geol. För. Förh.*, 1901, 23, 42).—Crystals of gahnite, in association with iron-pyrites, copper-pyrites, and pyrrhotite, occur embedded in quartz-veins in a grey, garnetiferous gneiss at the Snuggens Copper Mine in the parish of Färila, Helsingland. The octahedral crystals are frequently twinned according to the spinel-law and measure up to 2 cm. across; they are black to blackish-green and have a vitreous to greasy lustre; splinters are translucent with a bottle-green colour; the streak is light green. Analysis gave:

$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	$\text{ZnO}$ .	$\text{MgO}$ .	$\text{SiO}_2$ .	$\text{CaO}$ .	Total.	Sp. gr.
55·85	9·44	32·11	2·47	0·12	trace	99·99	4·39

This composition corresponds with the formula



The other localities for zinc-spinel in Sweden are enumerated.

L. J. S.

**Calcite Crystals from Gräsberg, Sweden.** By MATS WEIBULL (*Jahrb. Min.*, 1902, i, Ref. 172; from *Geol. För. Förh.*, 1900, 22, 19—27).—A description is given of large crystals of calcite, which occur in crevices and druses in the iron-ores of Gräsberg, in Dalarne. The crystals have varied considerably in form at different periods of their growth, the earlier forms being marked out by enclosures of chlorite, göthite, &c. In order to determine whether this variation in form is due to differences in chemical composition, analyses were made of material from different portions of the crystals; no definite conclusion was, however, arrived at, although the development of certain crystal-faces does appear to depend on the presence of iron. The crystals contain, besides calcium carbonate,  $\text{MgCO}_3$ , 0·025—0·1 per cent., and  $\text{FeCO}_3$ , 0·033—0·75 per cent. (in the latter case, göthite was present).

L. J. S.

**Neotantalite; a New Mineral.** By PIERRE TERMIER (*Bull. Soc. franç. Min.*, 1902, 25, 34—38).—Minute, regular octahedra of the new mineral are obtained, together with cassiterite, as a heavy residue by washing the kaolin from Colettes and Échassières, dép. Allier, France. The crystals are of a pale yellow colour with a brilliant, almost adamantine lustre and resemble pyrochlore in appearance; they are optically isotropic;  $n$  1.9; sp. gr. 5.193; H 5—6. Analysis, by Pisani, gave the results under I; after deducting white mica and cassiterite, the composition of the mineral is given under II. Under the microscope, the crystals are seen to enclose, besides mica, also manganiferous hæmatite, so that the pure mineral probably does not contain more than 6 or 7 per cent. of  $\text{FeO} + \text{MnO}$ :

	$\text{Ta}_2\text{O}_5$ .	$\text{Nb}_2\text{O}_5$ .	$\text{FeO}$ .	$\text{MnO}$ .	$\text{SnO}_2$ .	Alkalis, (K, Na, Li).	$\text{SiO}_2$ .
I.	57.70	22.00	4.57	2.85	0.43	2.50	1.32
II.	60.58	23.10	4.80	3.00	—	2.31	—

	$\text{Al}_2\text{O}_3$ .	$\text{MgO}$ .	U.	$\text{H}_2\text{O}$ (at 1200°).	Total.
I.	1.43	trace	trace	6.30	99.24
II.	—	—	—	6.51	100.30

The new mineral is, chemically, quite distinct from the cubic tantalates and niobates of the pyrochlore group (pyrochlore, hatchetolite and microlite), and although it also differs considerably in composition from tantalite, it is considered to be a dimorphous form of this mineral. It is pointed out that certain of the crystal-angles of the rhombic tantalite approximate to those of cubic crystals.

L. J. S.

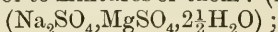
**A Peculiar Occurrence of Salts in the Magdeburg-Halberstadt Basin.** By K. KUBIERSCHKY (*Sitzungsber. Akad. Wiss. Berlin*, 1902, 404—413).—A single specimen, from Wilhelmsball in the Stassfurt (more correctly Magdeburg-Halberstadt) salt district, consisting of colourless, and at first sight apparently homogeneous, material with an irregular fracture, gave in seven analyses the following extreme values:

$\text{K}_2\text{SO}_4$ .	$\text{MgSO}_4$ .	$\text{Na}_2\text{SO}_4$ .	$\text{H}_2\text{O}$ .	$\text{NaCl}$ .
6.2—47.0	9.6—25.1	40.4—68.0	0.5—7.4	0.7—1.3

The curves obtained on plotting the results of these analyses indicate that the following salts are present in the mixture:

- (i)  $3\text{Na}_2\text{SO}_4 \cdot \text{MgSO}_4$ , to which the name *vanthoffite* is given;
- (ii) the triple salt,  $3\text{K}_2\text{SO}_4 \cdot 4\text{MgSO}_4 \cdot 6\text{Na}_2\text{SO}_4 \cdot 8\text{H}_2\text{O}$ , which, however, may be a mixture of vanthoffite and  $\text{K}_2\text{SO}_4 \cdot \text{MgSO}_4 \cdot \text{Na}_2\text{SO}_4 \cdot \frac{8}{3}\text{H}_2\text{O}$ ;
- (iii)  $(\text{K}, \text{Na})_2\text{SO}_4$  (aphthitalite).

Eleven more analyses are given of material from a second and similar specimen which was separated into several portions according to small indefinable differences in appearance, and also by the aid of heavy liquids; these portions approximate in composition to the following mineral species or to mixtures of them: (i) löweite





(ii) vanthoffite ; in the purest condition obtained, this is colourless with a vitreous lustre and coarsely crystalline structure, sp. gr. 2·7 (after deducting 10·2 per cent. of admixed sodium chloride), hardness rather over 3 ; (iii) apthitalite.

Attempts to artificially produce the triple sulphate noted above were unsuccessful ; in one experiment, a salt having the composition  $2K_2SO_4 \cdot Na_2SO_4$  was obtained.

J. H. VAN'T HOFF, in an appendix (pp. 414—415), describes the means by which he prepared the salt  $3Na_2SO_4 \cdot MgSO_4$  (vanthoffite) artificially. Crystals of blödite ( $Na_2SO_4 \cdot MgSO_4 \cdot 4H_2O$ ), which at 22° are deposited from a solution containing equal molecular proportions of sodium and magnesium sulphates, when heated at 70° in the liquid lose some of their water and are transformed to löweite ( $Na_2SO_4 \cdot MgSO_4 \cdot 2H_2O$ , according to van't Hoff), whilst at a still higher temperature crystals of the anhydrous salt,  $3Na_2SO_4 \cdot MgSO_4$ , are formed. Other methods for the preparation of this salt are detailed.

L. J. S.

The Saline Sublimation Products of Vesuvius and the amounts of Molybdenum, Bismuth, Cobalt and Zinc therein. By EUGENIO CASORIA (*Chem. Centr.*, 1902, i, 828 ; from *B. Oss. Montcalieri*, [ii], 19, 86—89 ; 20, 2—7).—The crusts, stalactites, &c., formed since 1891 in the central crater in Atrio del Cavallo contain more potassium than sodium ; molybdenum and zinc are also present in determinable amounts, but only traces of bismuth and cobalt. The composition of the sublimation products which have been formed since 1891 is very variable ; they may consist of alkali chlorides alone or mixed with alkali sulphates and carbonates, or of mixtures of acid and normal alkali sulphates, together sometimes with free sulphuric acid or of complex salts. The products formed by the decomposition of the lava by the acid exhalations are found in close proximity to the sublimation products.

E. W. W.

Talc and Pyrophyllite Deposits in North Carolina. By JULIUS H. PRATT (*Jahrb. Min.*, 1902, i, Ref. 12—13 ; from *North Carolina Geol. Survey, Economic Papers*, 1900, No. 3, pp. 1—29).—Talc, of economic value, occurs in Cherokee and Macon counties as lenticular masses in marble at the contact of the latter with quartzite. The mineral is white, grey, or dark blue, and has a fibrous structure. Analyses by C. Baskerville of material from different mines are given under I—III. The marble contains tremolite, and near its contact with the quartzite has the composition of nearly pure dolomite. The talc is considered to be an alteration product of the tremolite, which itself was formed during the metamorphism of limestone to marble :

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	Na <sub>2</sub> O.	K <sub>2</sub> O.	H <sub>2</sub> O.	Total.
I.	63·07	1·56	0·67	0·30	28·76	0·79	—	4·36	99·51
II.	61·35	4·42	1·68	0·82	26·03	0·62	—	5·10	100·02
III.	56·80	9·06	1·84	1·40	23·98	0·72	—	6·14	99·94
IV.	61·27	25·66	5·37	0·60	trace	0·83	0·11	5·86	99·70
V.	64·53	29·40	0·67	trace	trace	0·28	trace	5·45	100·33
VI.	63·50	28·73	0·84	trace	trace	0·37	trace	5·85	99·29

Pyrophyllite is mined in Moore and Chatham counties, and under the trade name of agalmatolite is used in place of talc. It occurs as beds in pyrophyllite-schist. The pure material is soft and flaky, and varies in colour from green and yellowish-white to nearly white; there are also black varieties, but these are of no commercial value. Analyses by C. Baskerville are given of the black (IV), yellowish (V), and apple-green (VI) material.

In analysis IV,  $\text{Al}_2\text{O}_3 : \text{SiO}_2 : \text{H}_2\text{O} = 1.08 : 4 : 1.12$ .

„ V, „ = 1.08 : 4 : 1.24.

L. J. S.

[Muscovite] from Haddam Neck, Connecticut. By HERBERT L. BOWMAN (*Min. Mag.*, 1902, 13, 97—121).—A description is given of each of the following minerals from a pegmatite vein at Haddam Neck, Connecticut: muscovite, lepidolite, tourmaline, apatite, microcline, albite, beryl, quartz, cookeite, fluor, microlite and columbite. There are three varieties of muscovite: (1) colourless, in large sheets up to two feet across; (2) greenish-white, occurring as a central core in crystals of lepidolite; (3) pink and fibrous, coating the exterior of the crystals of lepidolite, and, at first sight, appearing to be an alteration product of this. The muscovite of the second and third varieties is grown in parallel or twinned position on the lilac-coloured lepidolite, which itself also consists of two varieties, depending on whether the optic axial plane is parallel, or perpendicular, to the plane of symmetry. The pink muscovite consists of masses of fibres of rhombic section attached together in parallel or twinned positions, so that the whole mass can be cleaved across as a single crystal; analysis of this variety gave the following results:

$\text{SiO}_2$	$\text{Al}_2\text{O}_3$	$\text{Fe}_2\text{O}_3$	MnO.	$\text{K}_2\text{O}$	$\text{Na}_2\text{O}$	$\text{Li}_2\text{O}$	$\text{P}_2\text{O}_5$	F.	$\text{H}_2\text{O}$	Total less O for F.
46.28	36.86	0.97	trace	10.63	1.41	0.26	0.09	0.38	4.38	101.10

L. J. S.

Thomsonite and Apophyllite from Schiket (Colonia Eritrea). By GIOVANNI D'ACHIARDI (*Atti R. Accad. Lincei*, 1902, [v], 11, i, 251—254).—The author gives descriptions of specimens of (1) thomsonite, of the Färelite variety, which has a hardness of about 5, a sp. gr. of 2.25, and gave on analysis the following numbers:

$\text{SiO}_2$	$\text{Al}_2\text{O}_3$	CaO.	$\text{Na}_2\text{O}$	$\text{K}_2\text{O}$	$\text{H}_2\text{O}$	Total.
41.30	29.49	11.61	5.11	traces	13.32	100.83

(2) Apophyllite, of the tesselite variety, having a hardness of 5 and sp. gr. 2.2; scarcity of the material prevented an analysis being made, identification being based on qualitative tests, and on optical and crystallographic examination.

T. H. P.

Barylite and Cordierite. By MATS WEIBULL (*Jahrb. Min.*, 1902, i, Ref. 176—178; from *Geol. För. Förh.*, 1900, 22, 33—42).—A re-examination of Blomstrand's barylite shows that the indistinct crystals are rhombic with a prism angle of  $44^\circ 26'$ . The milk-white colour of the mineral, and the small amount of water (0.15 per cent.) it contains, are due to numerous fluid enclosures. Some of the optical

characters have been determined. Blomstrand's empirical formula,  $Ba_4Al_4Si_7O_{24}$ , is written graphically in accordance with Clarke's theory of the silicates to show a relation between barylite, cordierite, knebelite and muscovite.

Cordierite occurs as large, light-blue individuals in copper-pyrites, blende and hornblende at the Långfalls Mine, Grangårde, Dalarne. It encloses, to the extent of a few per cent., sillimanite, dark (organic?) grains, and the alteration products, muscovite, talc and kaolin. Analysis by L. Ramberg gave :

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	MnO.	MgO.	Loss at 300°.	Loss on ignition.	Total.
48.90	32.54	0.95	2.96	trace	11.46	0.77	1.65	99.23

Neglecting the water, as probably due to alteration, this gives the formula  $R''_2R'''_4Si_5O_{18}$ , which is written constitutionally as  $[(Mg,Fe)(Al,Fe)(AlO)]_2(SiO_4)_2(Si_3O_8)$ .  
L. J. S.

Kaolin from near Spezia, Italy. By E. SALLE (*Jahrb. Min.*, 1902, i, Ref. 173 ; from *Atti Soc. Toscana Sci. Nat.*, 1900, *Proc. Verb.*, 12, 103—106).—The following analysis is given of kaolin from the neighbourhood of Spezia. It is known as terra bianca, and was formerly thought to be chalk ; it has been formed by the decomposition of "euphotite" :

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	CaO.	MgO.	H <sub>2</sub> O.	Fe <sub>2</sub> O <sub>3</sub> .	Alkalis.	Total.
48.65	35.20	2.79	0.65	11.30	[1.41]		100.00
							L. J. S.

Composition of the Magma at Different Stages of an Eruption. By H. ARSANDAUX (*Bull. Soc. franç. Min.*, 1901, 24, 466—472).—The following analyses are given of ejected bombs of pyroxene-andesite from Santorin. I is of a bomb ejected at the beginning of the eruption in 1866 ; II in 1867 ; and III at the end of the eruption in 1868, IIIa being of material from the external portion, and IIIb from the internal portion of the bomb. These analyses go to show that during the period of eruption there has been no important variation in the composition of the magma. Calculating from these analyses the amounts of magnetite, pyroxene, albite and anorthite, there remains for the glassy base little alumina and much silica :

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	Na <sub>2</sub> O.	K <sub>2</sub> O.	Loss on ignition.	Total.
I.	67.6	16.5	1.6	3.4	2.6	2.2	4.9	1.8	0.7	101.3
II.	66.0	18.1	1.2	2.9	2.2	2.2	4.0	4.2	0.7	101.5
IIIa.	66.1	17.6	1.7	3.7	3.1	2.1	3.9	1.6	0.9	100.7
IIIb.	67.3	17.2	1.4	3.2	2.5	2.0	4.7	2.1	1.1	101.5

L. J. S.

## Physiological Chemistry.

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**Viscosity of the Blood.** By RUSSELL BURTON-OPITZ (*Amer. J. Physiol.*, 1902, 7, 243—260).—The average viscosity coefficient of frog's blood at 20° is 1300, of tortoise blood 1285, of rabbit's blood at 37°, 1350. The viscosity of frog's and tortoise's blood varies inversely as the temperature, a rise of 5° producing a rise of about 200 in the coefficient; thus at 37° it reaches 1700 in the frog and 1800 in the tortoise. The average viscosity of blood-serum at 20° is 1800. The viscosity coefficients of normal living blood vary widely, whilst those of the serum vary but little; the changes are therefore largely dependent on the solid elements of the blood. The specific gravity of frog's blood is altered by changes in the temperature in which the animal is placed; it is increased by potassium oxalate, curare, and deep etherisation, and diminished by defibrination. As similar changes are observed in the viscosity, considerable variations in the specific gravity may be taken as an index of variations in the viscosity.

W. D. H.

**The Spleen and Blood Corpuscles.** By DIARMID NOËL PATON, G. LOVELL GULLAND, and J. S. FOWLER (*J. Physiol.*, 1902, 28, 83—106).—The number and character of the red blood corpuscles going to and coming from the spleen are the same. The leucocytes, especially those of the polymorphonuclear variety, are diminished. Removal of the spleen has no influence on the number of blood corpuscles, except a slight fall in the proportion of eosinophile leucocytes; the proteids of the plasma are also unchanged. After hæmorrhage or hæmolysis, the regeneration of red corpuscles occurs as rapidly in animals without a spleen as in those with one. Injection of spleen extract does not cause an increase in the red corpuscles, such as injection of extract of red bone-marrow produces. In the animals examined (dog, cat, rabbit), the spleen cannot be regarded as a blood-forming organ. The leucocytes formed in the Malpighian corpuscles are not supplied in any large number to the blood which leaves the spleen.

W. D. H.

**Coagulation of Blood in Marine Animals.** By FILIPPO BOTTAZZI (*Arch. ital. Biol.*, 1902, 37, 49—54).—Among invertebrates, it is only in the group of the decapod crustaceans that a true coagulation of the blood is observed. Previous injection of 'peptone' does not prevent the coagulation of the blood when it is shed; but both 'peptone' and potassium oxalate do so *in vitro*; to do this, very large quantities must be added. 'Peptone' prevents the coalescence of the cells, and probably preserves them from profound alteration. In Elasmobranch fishes, 'peptone' injected into the hepatic portal vein in the proportion of 0·5—0·8 gram per kilo. of body weight acts as in other vertebrates.

W. D. H.



**Lipolytic Function of the Blood.** By MAURICE DOYON and ALBERT MOREL (*Compt. rend.*, 1902, 134, 621—623).—In the normal blood of dog and horse kept aseptically at 37° in the presence of oxygen, the ethereal extract diminishes, but there is no simultaneous appearance of glycerol, fatty acids, or soaps, nor any change in the reaction of the blood. This action takes place mainly in the corpuscles; the change in the serum is very slight. W. D. H.

**Effects on the Constituents of the Blood, of Intravascular Injection of Hypertonic Salt Solutions.** By S. A. VAN LEER (*Zeit. Biol.*, 1902, 43, 52—66).—The investigation aimed at ascertaining whether in the elevation of the osmotic pressure of the blood produced by injecting hypertonic solutions of sodium sulphate, the proteids and the salts (sodium chloride and carbonate), work together so as to produce compensation by going out of the blood, as Hamburger states. This is answered in the negative. W. D. H.

**The Action of Lecithin on the Formed Elements of the Blood.** By HENRI STASSANO and F. BILLON (*Compt. rend.*, 1902, 134, 318—321).—Recent observations have shown that lecithin acts favourably on nutritive processes, being an easily assimilable form of phosphorus compound. The present experiments on rabbits show that intravenous injection of lecithin prepared from eggs increases the number of red blood corpuscles, and increases their resistance to certain saline solutions. It also increases the number of leucocytes, particularly of the mononuclear variety. W. D. H.

**Electrical Resistance, Index of Refraction, and Rotatory Power of Normal Serum.** By DONGIER and LESAGE (*Compt. rend.*, 1902, 134, 834—835).—Blood serum from healthy animals and men was examined; the electrical resistance at 16° varied from 93 to 103 ohms in animals, 100 to 300 in man; this is in proportion to the amount of inorganic salts; the refractive index varied from 1.3462 to 1.3503; the rotatory power from 1°14' to 2°11'.

W. D. H.

**An Experimental Abnormality of Metabolism.** By HERMANN HILDEBRANDT (*Zeit. physiol. Chem.*, 1902, 35, 141—152).—Administration of large quantities of dextrose to rabbits produces an acute toxic condition, which can be hindered by giving calcium carbonate, whereby the reaction of the urine becomes alkaline. Glycuronic acid is an oxidation product of dextrose, and administration of large amounts of glycuronic acid causes an increased excretion of oxalic acid (P. Mayer, *Deut. med. Woch.*, 1901, Nos. 16 and 17). The poisonous symptoms referred to are due to an increased formation of oxalic acid; this acid appears in large quantities in the urine after abundant carbohydrate nutriment, but this is lessened by giving calcium carbonate. Lactose does not produce the same result. Oxaluria is a common symptom of diabetes in man; the administration of chalk is recommended.

W. D. H.

**Purine Derivatives in Human Fæces.** By MARTIN KRÜGER and A. SCHITTENHELM (*Zeit. physiol. Chem.*, 1902, 35, 153—163).—In the course of 42 days, the following quantities of bases were found in the fæces of a man: guanine 2.363, adenine 1.88, xanthine 0.112, hypoxanthine 0.3, a total of 4.655, or a daily average of 0.11 gram; this is about three times the amount passed in the urine. W. D. H.

**Duodenal Digestion of Proteid.** By CARLO FERRAI (*Pflüger's Archiv*, 1902, 89, 527—546).—If proteid matter (cubes of coagulated albumin) is introduced into the duodenum of a dog in full digestive activity and the animal is then killed, the proteid is digested. The greatest intensity of digestion occurs in the first hour after death; it then rapidly falls, and practically ceases at the ninth hour. This is not due to the cooling of the corpse, but to other undetermined factors. The external temperature makes little or no difference. If the digestive processes are thrown into action by a meal given previously to the operation above described, the digestive action on the albumin cubes rises after death, and reaches a maximum 2½ hours later. If so much as four hours intervene between the preliminary meal and death, the digestive processes are weaker. The action appears to depend on the absolute quantity of active ferment, not on its concentration. The duodenal contents of an unfed animal have a digestive action on proteids. W. D. H.

[Rôle of the Bile in Saponification.] By EDUARD PFLÜGER (*Pflüger's Archiv*, 1902, 90, 1—32).—A method for estimating soaps and fatty acids in the presence of bile is described. Mixtures were used containing stearic and oleic acids, bile, and sodium hydroxide solution (1 per cent.); the amount of fatty acid in the form of soap subsequently varies from 53 to 65 per cent. Approval is expressed of Pawloff's idea concerning the self-steering action of intestinal digestion. The fatty acid liberated assists the hydrochloric acid from the stomach in stimulating the duodenum, and so producing a greater flow of pancreatic juice rich in steapsin; this resolves more and more fat, and the bile is mainly instrumental in rendering soluble the products of fat resolution. The author does not consider that Bayliss and Starling have as yet proved their contention that the link between duodenum and pancreas is not nervous. W. D. H.

**Action of Extracts of *Ascaris Lumbricoides*.** By ERNST WEINLAND (*Zeit. Biol.*, 1902, 43, 86—111. Compare this vol., ii, 155).—The previous research has shown that in the production of carbon dioxide and valeric acid in the metabolic processes of the round worm, *Ascaris*, a ferment action and not oxidation is the main factor concerned. In the present communication, the same action is studied in extracts squeezed out from the disintegrated worm, and the experiments recorded support the contention that the action is due to a ferment. W. D. H.

**Intestinal Absorption.** By E. WAYMOUTH REID (*J. Physiol.*, 1902, 28, 241—256).—The study of the absorption of weak solutions

of dextrose in the intestine, the mucous membrane being as normal as experimental procedure will admit, shows that the phenomena are such that a simple physical explanation is impossible. This corresponds with results previously obtained in the study of the absorption of serum. Probably with weak solutions of non-irritating substances the specific cell-action is the main factor, variable directly or indirectly according to changes in the physical environment. There is some evidence that chemical excitation may also play a part.

W. D. H.

**Absorption of Carbohydrates by the Rectum.** By FELIX REACH (*Chem. Centr.*, 1902, i, 824; from *Arch. exp. Path. Pharm.*, 1902, 47, 231—249).—From the standpoint of feeding *per rectum*, it is important to know whether carbohydrates are absorbed by the rectal mucous membrane. The method of experiment was to give enemata containing carbohydrates, and investigate the effect on the respiratory quotient, which approaches unity when abundant carbohydrate nutriment is given. The enemata contained 60 grams of dextrose, sucrose, maltose, or dextrin. The respiratory quotient rose, but more slowly and to a smaller extent than when the carbohydrate was given by the mouth. Starch enemata produced a still smaller and slower effect. In mouth feeding, there is an absolute rise in the respiratory gas exchange, due possibly to increased work of the digestive organs. This was not noticed in rectal feeding; glycosuria and dextrinuria did not occur.

W. D. H.

**Erepsin.** By OTTO COHNHEIM (*Zeit. physiol. Chem.*, 1902, 35, 134—140).—Erepsin acts rapidly on proteoses and peptones, and among the products of its action, ammonia, leucine, tyrosine, lysine, histidine, and arginine were identified. Erepsin acts also on protamines, and feebly on histon. It has no effect on any other of the native proteids investigated except caseinogen, which is rapidly split up. This opens up the interesting possibility that the suckling infant could digest its proteid nutriment in the absence of both pepsin and trypsin.

W. D. H.

**Chemical Composition of New-born Children.** By WILLIAM CAMERER, jun., SÜLDNER, and HERZOG (*Zeit. Biol.*, 1902, 43, 1—12).—Further analyses on the lines of the authors' previous work are given.

W. D. H.

**Osmotic Properties of Colloidal Solutions.** By BENJAMIN MOORE and WILLIAM H. PARKER (*Amer. J. Physiol.*, 1902, 7, 261—293).—Colloids in solution exert a definite osmotic pressure. This is not due to contamination with crystalloids. The only way of determining this is the direct one, variations in freezing or boiling points being so small. The pressure cannot be used to determine the mol. weight of colloids, for soaps by this method give *apparent* molecular weights 20 to 60 times too large. The physical constant which determines the osmotic pressure of a colloid is an osmotic unit or 'solution aggre-

gate' arising from the physical union or association of a variable number of molecules. This is four or five times as great for serum-albumin as for egg-albumin; that of serum-albumin is reduced to a fifth by alkalis. Even dilute solutions of sodium soaps form colloidal solutions in distilled water at temperatures from 50—70°, which do not diffuse through parchment paper. On cooling such solutions, hydrogels are obtained, which again yield solutions on heating. Such hydrogels are precipitated in granular form on keeping. Rapid cooling and increased strength of solution tend to the formation of hydrogels, whilst the opposite conditions tend to granule formation. These phenomena have their analogues in the passage of crystalloids from solution. The difference in the properties of the coagulable proteids may be due to different physical arrangements of chemical molecules to form different aggregates, and the complexity of the proteid molecule may be much more a physical than a chemical phenomenon. Protoplasm may be built up by a continuation of such a process; absorption by a cell may be governed by the formation of varying aggregates with the protoplasm already there, and similarly granule formation in the cells may also take place. The osmotic pressure of proteids probably takes no share in lymph production or absorption, for there is no evidence that capillary walls are impermeable to proteid, or that there is any appreciable difference in concentration in the two sides of the capillary wall. The cells of the membranes in the glomeruli of the kidneys probably act as secretory structures, for the differences in pressure are probably not sufficient to cause pressure filtration of a proteid-free filtrate, and are certainly many times too small to separate carbohydrate in this manner.

W. D. H.

**Formation of Lymph by the Liver.** By F. A. BAMBRIDGE (*J. Physiol.*, 1902, 28, 204—219).—The intravenous injection of moderate quantities of sodium taurocholate or of pure hæmoglobin leads both to an increased flow of lymph from the liver and increased metabolism in the liver cells. These substances constitute a class of lymphagogues additional to the two described by Heidenbain. The experiments support Asher's view that increased tissue activity causes an increase of lymph formation. Asher, however, goes too far when he says it is the sole cause. The statement of Asher that peptone, bile, and hæmoglobin are cholagogues is not confirmed. The increased activity of the liver leads to a formation of crystalloid katabolic products, which enter the lymph by diffusion and raise its osmotic pressure, so increasing the flow of water by osmosis from the blood. The injection of ammonium salts sometimes causes an increased lymph flow, but the results are so inconstant that no conclusions are drawn as to its cause. The experiments were made on dogs. W. D. H.

**Effects of Potassium and Calcium Ions on Striated Muscle.** By W. D. ZOETHOUT (*Amer. J. Physiol.*, 1902, 7, 199—202).—Potassium ions produce a prolonged contraction of the striated muscle (gastrocnemius) of the frog; calcium ions, and to a lesser extent sodium ions, antagonise this action. This is almost the converse of



what obtains in the case of cardiac muscle, and has been previously described by Ringer and others. W. D. H.

**Lecithins.** By MAURICE BERNARD (*Chem. Centr.*, 1902, i, 854; from *Apoth.-Zeit.*, 17, 186—187. Compare Desgrez and Zaky, *Abstr.*, 1901, ii, 518).—The original paper contains a short description of the constitution, preparation, behaviour, and physiological action of lecithins. According to L. Vacheron (*La lécithine, nouvelle forme de la médication phosphorée*, 1902) the following amounts of lecithin are contained in 100 parts of the substances named: brain substance 11, liver 2.2, thymus 7.5, spermatozoa 1.50, red blood-corpuscles 0.72—1.86, milk 0.10, yolk of egg 6.80, peas 1.00, and lentils 1.00. Danilewsky finds that lecithins cause the red blood-corpuscles and hæmoglobin to increase, and promote growth. E. W. W.

**Ichthylepidin in the Scales of American Fishes.** By ERIK H. GREEN and R. W. TOWER (*Zeit. physiol. Chem.*, 1902, 35, 196—200).—The albuminoid called ichthylepidin by C. T. Mörner (*Abstr.*, 1898, ii, 85) is formed in the scales of a large number (32 varieties) of American teleostean fishes. The only teleostean in which it was not found is the sun-fish (*Mola mola*). It is present in the scales of the sturgeon, a ganoid, although, according to Mörner, it is absent from the scales of another ganoid, the gar-pike (*Lepidosteus osseus*). It was absent from the scales of four elasmobranchs. W. D. H.

**Pentoses in the Organism.** By GEORG GRUND (*Zeit. physiol. Chem.*, 1902, 35, 111—133).—Salkowski has shown that pentoses may appear in the urine as the result of metabolism, and Hammarsten that the nucleo-proteid of the pancreas yields a pentose on decomposition. It is now shown that other organs (liver, thymus, thyroid, spleen, kidneys, salivary glands, brain, and muscle) contain substances which also yield pentoses. The total amount of pentose obtained from the pancreas was 0.393 gram, that from all the organs just enumerated was 10.6 grams. W. D. H.

**Action of Rennin on Milk.** By ERNST FULD (*Beitr. chem. Physiol. Path.*, 1902, 2, 169—200).—The relationship between concentration of rennin and time of coagulation is found to be a constant one; other observations relate to the influence of temperature, and a large section of the paper is concerned with a discussion of theories concerning the action of the ferment. Milk curdling is regarded as a special case of the alternation between suspension and precipitation of a colloidal substance. During the change there is a development of heat, a slight elevation of the freezing point, but no notable change in the viscosity. W. D. H.

**Production of Uric Acid from Free Purine Bases.** By MARTIN KRÜGER and JULIUS SCHMID (*Zeit. physiol. Chem.*, 1902, 34, 549—565).—The conversion of hypoxanthine into uric acid in the animal system, appears to be a direct conversion, as it is not accompanied by leucotactic action, or by alterations in the phosphoric acid derivatives.

Adenine, xanthine, and probably guanine exert the same influence as hypoxanthine on the excretion of uric acid.

A small amount of the ingested adenine and xanthine contributes to a very slight increase in purine bases. J. J. S.

**Fatigue in Nerves.** By THOMAS GREGOR BRODIE, and WILLIAM D. HALLIBURTON (*J. Physiol.*, 1902, 28, 181—200).—By means of experiments similar to those made by other investigators on medullated nerves, the non-medullated nerves are also shown to be non-fatiguable. The block employed was cold, and the splenic nerves were those with which the greater number of the experiments were performed. Waller's hypothesis that the non-appearance of fatigue is due to the nutritive action of the fatty sheath is therefore not confirmed. Some of the nerves used especially those which are vaso-motor, exhibit what has been termed 'stimulation, fatigue'; that is, the actual spot excited by a faradic current becomes less and less excitable and finally non-excitable. It is, however, still capable of conducting nerve impulses. The phenomenon is probably due to the injurious polarisation produced by the electric currents used. Non-medullated nerves are very sensitive to galvanic currents, and are rendered non-conducting and non-excitable. These nerves also are but little affected by chemical, thermal, and even mechanical excitation. They do not become acid even after many hours' activity. W. D. H.

**The Relation of Nitrogen and Carbon in Infants' Urine.** By VON OORDT (*Zeit. Biol.*, 1902, 43, 46—51).—Heubner and Rubner found in their experiments on puppies that the relative proportion of carbon in the urine was high. This is also true for children, especially when nourished on mother's milk; albumin and sugar are absent. W. D. H.

**Excretion of Ammonia in Human Urine.** By WILLIAM CAMERER, jun. (*Zeit. Biol.*, 1902, 43, 13—45).—The absolute amount of ammonia excreted is dependent on proteid katabolism, and thus on the amount of proteid nutriment. Growing individuals have a relatively high amount in the urine. In the course of the day urea excretion rises from the morning, reaching its maximum between 3 and 7 p.m. It then falls again, with a second small rise between 10 p.m. and 2 a.m. Ammonia excretion is high in the morning, reaches a minimum between 11 and 3, then rises and remains fairly constant until 2 a.m., when it rises again. The effects of diet and of the administration of acid and alkali are also given. In diabetic coma, the amount of ammonia in the urine rises considerably. W. D. H.

**Diuretic Action of Isotonic Salt Solutions.** By B. HAAKE and KARL SPIRO (*Beitr. chem. Physiol. Path.*, 1902, 2, 149—154).—Limbeck was the first to show that a solution of sodium chloride isotonic with the blood produces an increased flow of urine. Others subsequently showed that an isotonic solution of sodium sulphate produces a greater effect. The present experiments on rabbits show that solutions of sodium chloride, bromide, nitrate and sulphate, dextrose,

and sucrose, all isotonic with the blood, produce a diuretic effect. This is shown graphically in the form of curves. Of the substances mentioned, the effect of sodium chloride is least and most slowly developed. The activity of these substances as diuretics is not proportional to their toxicity.

W. D. H.

**The Work of Secretion in Diseased Kidneys.** By FRANZ SOETBEER (*Zeit. physiol. Chem.*, 1902, 35, 85—110).—The daily work of the kidneys in acute nephritis and amyloid disease is much smaller than in health. In interstitial nephritis, the work is about equal to that of the healthy kidneys, except that the excretion of uric acid is irregular; the actual amount of water is greater. In the two first-named diseases, the excretion of nitrogenous substances is fairly regular, still periods of retention alternate with periods of increased activity; this is very marked in the case of the mineral constituents of the urine; the retention of inorganic salts is not the cause of uræmia; this condition is probably related to the retention of organic substances, but the exact cause is not yet clear. In amyloid degeneration, the excretion of organic acids is increased.

W. D. H.

**Action of Curare on the Excretion of Carbon Dioxide and Nitrogen.** By OTTO FRANK and F. VON GEBHARD (*Zeit. Biol.*, 1902, 43, 117—124).—The present research was undertaken in view of contradictory results obtained by previous observers. The experiments were made on dogs; the carbon dioxide excretion fell from 11·15 grams per hour in the normal animal to 9·86—10·74 in the curarised animal, a fall of only 3·6 per cent. The excretion of nitrogen, however, fell enormously to only 25 per cent. of the normal.

W. D. H.

**Constitution of the Pancreas-Proteid-Pentose.** By CARL NEUBERG (*Ber.*, 1902, 35, 1467—1475).—Having shown (*Abstr.*, 1901, i, 539) that the pentose, which is found in certain pathological urines, is *r*-arabinose, the author has now investigated the pentose, which occurs associated with nucleoproteids in many organs. For this purpose, the nucleoproteid was extracted from ox-pancreas with boiling water, and to the extract hydrobromic acid was added; the mixture was boiled, and then neutralised with lead carbonate, which removed all coloured and oily products of hydrolysis. The filtrate was evaporated under reduced pressure, the residue extracted with alcohol, and the syrup obtained on evaporating off the alcohol oxidised with bromine water. From this solution of the acid obtained from the pentose, lead acetate precipitated lead bromide, but only after adding ammonia was the lead salt of *l*-xylonic acid thrown down. The acid was recognised by conversion into its brucine salt, and the characteristic double salt with cadmium bromide. The pentose of the pancreas-proteids is therefore *l*-xylose.

K. J. P. O.

**Alcaptonuria.** By ERICH MEYER (*Chem. Centr.*, 1902, i, 364; from *Deut. Arch. klin. Med.*, 70, 443—467).—A case of alcaptonuria in a child is described; the secretion of homogentisic acid depends on

the proteid in the diet; it is increased by giving plasmon. The well-characterised ethyl homogentisate is recommended for the identification of the substance.

W. D. H.

**Urobilin in Ascitic Fluid.** By CONRAD STICH (*Chem. Centr.*, 1902, i, 364; from *Münch. med. Woch.*, 48, 1751).—In a case of parenchymatous hæmorrhagic nephritis, urobilin was present in the ascitic fluid.

W. D. H.

**Arcus Senilis.** By J. HERBERT PARSONS (*Proc. Physiol. Soc.*, 1902; *J. Physiol.*, 28, 9—10).—The staining reactions and solubilities of the globules found in the substantia propria of the cornea in the area affected in *arcus senilis* indicate that they are fatty in nature. The reaction of fats to both osmic acid and sudan III is ascribed by others to members of the acrylic series; the globules in question, however, although they are stained by the latter reagent, are unaffected by osmic acid.

W. D. H.

## Chemistry of Vegetable Physiology and Agriculture.

**Influence of Mineral Salts on the Respiration of Seeds during Different Periods of Germination.** By S. KRZEMIENIEWSKI (*Bull. Acad. Sci. Cracow*, 1902, 163—181).—In the first period of germination, mineral salts were found to be without effect, but after the maximum period of respiration had passed, addition of minerals resulted in a distinct acceleration of respiration, the assimilation of oxygen and the production of carbon dioxide being equally affected. When minerals are not added until the respiration has diminished considerably, owing to the reserved substances being much reduced in quantity, no accelerating action is observed, but the lessening of respiration is retarded.

The accelerating effect of mineral salts is due mainly to the potassium and the nitrates present; the other constituents are comparatively unimportant.

The amount of moisture in the substratum in which the plants are growing has a good deal of influence on respiration even when the air is saturated with moisture. The conclusion is drawn that increased root pressure is able to increase the respiration of the plant.

N. H. J. M.

**Do Germinating Seeds contain Peptonising or other Proteolytic Enzymes?** By THOMAS BOKORNY (*Pflüger's Archiv*, 1902, 90, 94—112).—Although the proteid matter of seeds during germination undergoes rapid solution, the non-discovery of peptone has hitherto been a difficulty, and researches directed to the isolation of a proteolytic enzyme have yielded contradictory results. An enzyme is present, and it appears to be of tryptic rather than of peptic nature.



This can be extracted from malt, and the name *peptase* is suggested. Leucine, tyrosine, asparagine, &c., were formed. It is possible that there are two enzymes, one that effects the solution of the globulin granules, and another that carries out the further decomposition which leads to the appearance of amino-acids.

W. D. H.

**Digestion of the Mannan of Orchid Tubers.** By HENRI HÉRISSEY (*Compt. rend.*, 1902, 134, 721—723).—The mannan of orchid tubers is converted into mannose by soluble ferments. The change can take place in the tubers themselves in proportion to the utilisation of reserve substance necessary for new growth. It can also be brought about by means of seminase from lucerne seeds.

N. H. J. M.

**Assimilation of Carbon by a Green Alga.** By P. G. CHARPENTIER (*Compt. rend.*, 1902, 134, 671—673).—*Cystococcus humicola* (Beyerinck, *Bot. Zeit.*, 1890) develops well in mineral solutions containing dextrose. It utilises the dextrose and also the carbon dioxide respired. Cultivations in closed vessels showed a production of carbon dioxide unaccompanied by any decided loss of oxygen. The presence of light is useful but not essential: the cells of *Cystococcus* produced in light are small and do not contain starch grains; they are coloured pale blue by iodine. In absence of light, the cells are large and full of large starch grains.

N. H. J. M.

**Effect of Temperature on Mineral Absorption by Etiolated Plants.** By GUSTAVE ANDRÉ (*Compt. rend.*, 1902, 134, 668—671).—Etiolated plants (maize and haricots), kept for 16 days at 30°, contained more total ash than similar plants kept at 15°; the difference was due to more silica having been taken up at the higher temperature.

The results relating to nitrogen did not show any very marked differences due to temperature, but as regards carbohydrates it was found that a distinctly greater production of vasculose took place at 30° than at 15°.

N. H. J. M.

**Rise of Colouring Matters in Plants.** By FRIEDRICH GOPPELS ROEDER (*Verhand. Naturforsch. Ges. Basel*, 1901, 14, 1—545).—See this vol., ii, 424.

**Chemical Reaction on the Surface of Roots.** By M. RACIBORSKI (*Bull. Acad. Sci. Cracow*, 1902, 51—54).—Leptomin was detected on the roots of every plant examined and probably occurs in all phanerogams; the quantity, however, varies a good deal. Maize, for instance, shows the reaction very plainly, whilst buckwheat only gave a very slight reaction. It was also detected in some above-ground portions of plants, but it is chiefly in the roots that the substance occurs.

The method employed for detecting leptomin is to lay the roots on paper saturated with an alcoholic solution of guaiacol (or *a*-naphthol) and add diluted hydrogen peroxide; an intense blue (or violet) coloration is at once produced. The colour is produced when seeds are germinated on the prepared paper.

N. H. J. M.

**Sugar of Mahwa-Blossoms.** By EDMUND O. VON LIPPMANN (*Ber.*, 1902, 35, 1448—1450).—A hard, crystalline sugar, resembling sucrose in appearance, was obtained from the syrup which is extracted from the blossom of *Bassia latifolia*. It was found, however, to be crystalline invert sugar. T. M. L.

**Constituents of the Pith of Maize and of Elder, and the simultaneous Occurrence of Araban and Xylan in Plants.** By C. A. BROWNE, jun., and BERNHARD TOLLENS (*Ber.*, 1902, 35, 1457—1467).—The pith of both maize and elder gave the phloroglucinol reaction for pentose, and on distilling with hydrochloric acid the reactions for furfuraldehyde and methylfurfuraldehyde. In each pith, the fibre, ash, fat, proteid, and nitrogen-free extractive were estimated. There was evidence that a sugar resembling dextrose was also present in maize-pith.

The maize-pith was hydrolysed with 6 per cent. sulphuric acid, and the sugar (pentoses) isolated from the product by the usual methods (Widstoe and Tollens, *Abstr.*, 1900, i, 207). Xylose and arabinose were both isolated; xylan and araban are, therefore, both present in maize-pith. From elder-pith both pentoses were similarly isolated. From each source, the corresponding wood-gum was isolated by extraction with 5 per cent. sodium hydroxide; that from maize-pith had  $[\alpha]_D - 68.8^\circ$ , whilst that from elder-pith had  $[\alpha]_D - 36.8^\circ$ . By hydrolysis with calcium sulphite much cellulose can be extracted; as its presence cannot be demonstrated by the usual tests in the pith, the cellulose must be in combination with lignin, &c. From the fibre of the pith, a considerable quantity of cellulose was prepared by Cross and Bevan's chlorine method.

The authors have shown that beechwood-gum contains arabinose as well as xylose, and that cherry-gum contains xylose as well as arabinose. K. J. P. O.

**Composition of Orchid Tubers at Different Periods.** By KURT RAMMELBERG (*Bied. Centr.*, 1902, 31, 256—257; from *Inaug. Diss. Erlangen*, 1899).—Invert sugar, sucrose, cellulose, and amylose were determined in young and old tubers of eleven varieties of orchids. The old tubers were found to contain the most cellulose, but generally they contain less invert sugar, sucrose, and amylose than the young tubers. The tubers contained (except in one case) more sucrose than invert sugar. The predominating constituent is amylose, especially the young in tubers. N. H. J. M.

**Sucrose in the Food Reserves of Phanerogams.** By ÉMILE BOURQUELOT (*Compt. rend.*, 1902, 134, 718—720).—The results of the examination of the roots, tubers, and grains, &c., of different plants showed that sucrose was present in 18 cases out of 20. The conclusion is drawn that sucrose is necessary in the case of all phanerogams (compare Schulze, *Abstr.*, 1899, ii, 570). N. H. J. M.

**Action of Metallic Copper on Roots.** By KARL B. LEHMANN (*Chem. Centr.*, 1902, i, 765; from *Münch. med. Woch.*, 49, 340).—On

growing beans, pumpkins, and peas in soil to which 7·5, 0·75, and 0·35 per cent. of copper had been added, it was found that the length of the roots was reduced, and that a number of short, hard, side branches were formed. The growth of the plants was decidedly injured by the presence of copper in the soil. N. H. J. M.

**Influence of the Sun on the Vine and Other Plants.** By MARCELLIN P. E. BERTHELOT (*Ann. Chim. Phys.*, 1902, [vii], 25, 433—452).—The grapes of a vine which has been injured by exposure to too intense sunlight are arrested in their development, the smallest grapes being those which have been most attacked by the sun's rays.

A long series of analyses of the proximate constituents of these imperfectly developed grapes indicates the connection between this arrested growth and the intensity of the sun's action. G. T. M.

**Conditions of Vegetation in High Yielding Vineyards.** By ACHILLE MÜNTZ (*Compt. rend.*, 1902, 134, 575—578).—To obtain the largest yields of grapes, it is necessary to apply very large amounts of manures. Under these conditions, there is a greater production of sugar in relation to the amount of manure applied than when the yield of grapes is only moderate. This is because the heavy application of manure tends to increase the yield of grapes more than that of the other organs.

Results are given showing that with the same leaf surface there may be very great differences in the amounts of sugar in the grapes, according to the quantity of manure, and it is supposed that in cases when the yield of sugar is low it is because the production of grapes was insufficient, the result being that the sugar was utilised in other ways. The important point would therefore seem to be to obtain a suitable relation of leaf to grapes in order to avoid, on the one hand, grapes poor in sugar, and, on the other, a loss of sugar owing to an insufficiency of grapes.

It is shown that leaving the grapes to mature as long as the climatic and soil conditions permit may result in a marked increase in the density of the must. N. H. J. M.

**Bananas.** By E. LEUSCHER (*Zeit. öffentl. Chem.*, 1902, 8, 125—134).—The following analyses of (1) green husks, (2) ripe husks, (3) unripe fruit, (4) ripe fruit (both without husks), (5) preserved bananas, and (6) banana-meal are given:

	Crude Water.	Crude protein.	Crude fat.	Crude fibre.	N-free extract.	Dex- Starch.	Tan- trin.	Suc- rose.	Invert sugar.	Ash.
1.	70·00	2·02	4·51	9·89	8·26	—	—	—	—	5·32
2.	70·00	2·94	4·10	8·62	10·43	—	—	—	—	3·91
3.	70·50	3·94	0·14	0·39	—	19·10	2·63	2·18	—	1·12
4.	67·10	4·98	0·18	0·26	—	—	0·95	0·14	15·83	0·86
5.	25·20	6·80	0·25	0·36	65·59	—	—	—	—	1·80
6.	15·00	6·98	0·30	(5·90)	70·04	—	—	—	—	1·73

The results under crude fibre in the meal (6) include colouring matter and tannin. Only the quite green fruit, containing not more than traces of sugar, can be utilised for preparing meal. N. H. J. M.

**A Study of the Available Mineral Plant Food in Soils.** By CHARLES C. MOORE (*J. Amer. Chem. Soc.*, 1902, 24, 79—116).—The method employed consists in growing each crop in a variety of soils in large pots kept in a glasshouse so as to eliminate climatic conditions. The weights of produce are expressed in parts per 100,000, and the weights of nitrogen, ash, and ash constituents in the crop in parts per million of the soil. The cropping was oats and beans, each crop being followed in the same year by buckwheat.

Samples of the same soils are digested for 5 hours with dilute hydrochloric acid of different strengths, the bottles containing the soil being agitated at a fixed rate in a modified Wagner apparatus in an iron constant temperature chamber. On comparing the amounts of mineral substance dissolved by the dilute acid with the amounts taken up by the crop, it is possible to ascertain which strength of acid gives, with the majority of soils, the results most closely approximating to those obtained in actual growth. The strongest acid employed was  $N/10$  hydrochloric acid, and this dissolved from two to seven times as much as the crop took up. Very striking results were obtained with  $N/200$  acid. Of the 65 soils studied (including some Rothamsted wheat and barley soils), nearly all gave results indicating to a marked degree of accuracy the conditions as brought out in the crops.

In reference to the method of extracting with dilute citric acid, it is shown that it is important to extract at a constant temperature. It was found that a soil from which 0.012 per cent. of phosphoric acid was dissolved at  $30^{\circ}$  yielded 0.024 per cent. at  $40^{\circ}$ . The amount of potash dissolved was not affected by a difference of  $10^{\circ}$ . The amount of solvent (1 to 3 litres) and an increase in the percentage of citric acid, from 1 to 2, were without effect on the results.

The results recorded in the present paper refer only to oats, and it is probable that with other crops other strengths of acid will be found more suitable.

The method employed for soil sampling in the field is similar to that used at Rothamsted, except that the sampling irons are 6 inches deep and are round, being made from 7-inch wrought iron pipes.

For ascertaining the general composition of soils, 10 grams of each soil were digested in a reflux apparatus heated on a water-bath for 1, 5, 10, and 20 hours respectively with hydrochloric acid of sp. gr. 1.115. From the results obtained, the conclusion is drawn that 10 hours' digestion would give fairly approximate results. N. H. J. M.

**Vegetable Soils.** By THÉOPHILE SCHLOESING (*Compt. rend.*, 1902, 134, 631—635).—Four soils (50 grams each) were separated by levigation into eight portions, the water being poured off after 15 seconds, 1 and 5 minutes, 1, 5, and 20 hours, and 10 months. The final liquid was merely opalescent and was precipitated with a little nitric acid. The total substance, the phosphoric acid, and the iron sesquioxide were determined in each separation. The most striking results are the rapid increase in the amounts of phosphoric acid and iron oxide with the decrease in the size of the soil particles, and the constant relation between the ferric oxide and the phosphoric acid.

The results also indicate that the amounts of phosphoric acid and



ferric oxide in the colloidal clay resemble those in the very finely divided constituents of the soil. N. H. J. M.

**Studies in Nitrification.** By J. G. LIPMAN (*J. Amer. Chem. Soc.*, 1902, 24, 171—186).—The results of experiments in which 100 grams of soil, with 0.1 gram of ammonium sulphate, 8—12 c.c. of water, and 1 c.c. of soil extract (for inoculation), were kept in closed flasks, showed that in each case practically all the nitrogen was oxidised in 36 days, but that in some cases nitrification was either incomplete, or reduction to nitrites had taken place. The extracts of the soils, after being kept for 19 days, were found, in most cases, to contain less nitric nitrogen than when first prepared.

Similar experiments were made to ascertain the effect of sodium chloride, 0.01—0.1 per cent. of the weight of the soil. The results indicate that sodium chloride up to 3500 lb. per acre may retard, but does not entirely check, nitrification. Ferrous sulphate (0.01—0.1 per cent.) had very little effect, although the larger amounts seemed to retard nitrification somewhat. Linseed meal, 0.1 per cent., was more favourable to nitrification than 0.5 per cent., and with 3 per cent. of linseed meal only traces of nitric nitrogen were produced.

N. H. J. M.

**Value of the Nitrogen in Farmyard Manure and its Analytical Determination.** By THEODOR PFEIFFER, OTTO LEMMERMANN, R. RIECKE, and C. BLOCH (*Bied. Centr.*, 1902, 31, 236—239; from *Mitt. Landw. Inst. K. Univ. Breslau*, 1901, Heft 5, 189—219).—The varying effect of farmyard manure is attributed to the breaking down of sparingly soluble nitrogenous compounds by proteolytic ferments and to the simultaneous action of organisms which render insoluble the more soluble nitrogen compounds.

Attempts were made to determine the relative values of farmyard manure by means of the solubility of the nitrogen in pepsin, the results being compared with those obtained by vegetation experiments with the same manures in pots and on plots. It was found that the manure produced very different effects, according to whether the soil employed was heavy or light, and it seems, therefore, doubtful whether it will be possible by any analytical method to estimate the value of dung in the proposed direction. The results of pepsin digestion show, however, in some cases, a relation to the effects as observed in the vegetation experiments.

It was found that the manure generally lost nitrogen in soluble pepsin when kept; in some cases there was a gain. N. H. J. M.

**Ammonia in Meteoric Waters. Red Rain.** By ADOLFO CASALI (*Staz. Sper. agrar. ital.*, 1901, 34, 833—848).—The nitrogen, in the form of ammonia, was determined in thirty-five samples of the rain and snow, &c., collected in Bologna, from Jan. 15 to March 28, 1901. The maximum, minimum, and mean amounts of nitrogen per million were as follows:

	Nitrogen, as ammonia (mg. per litre).		
	Maximum.	Minimum.	Mean.
Mist.....	0.057	0.014	0.045
Hoar frost .....	0.045	0.022	0.023
Snow .....	0.008	0.002	0.005
Rain .....	0.012	0.001	0.005

The red rain, which fell during the night of March 10—11 (compare Abstr., 1901, ii, 322) contained 1.96 c.c. of dry substance in suspension, having the following percentage composition (sp. gr. 2.25) :

CaO.	MgO.	Fe <sub>2</sub> O <sub>3</sub> and Al <sub>2</sub> O <sub>3</sub> .	SiO <sub>2</sub> .
4.87	2.22	34.98	57.75

The dust contains very little organic matter and was probably of meteoric origin. N. H. J. M.

## Analytical Chemistry.

Capillary Analysis, based on Capillary and Absorption Phenomena. Rise of Colouring Matters in Plants. By FRIEDRICH GOPPELSROEDER (*Verhand. Naturforsch. Ges. Basel*, 1901, 14, 1—545. Compare Abstr., 1899, ii, 572).—If one end of a strip of filter paper is immersed in a solution containing two or more dyes, the latter rise to different heights, giving a series of coloured zones. If these zones are cut off and extracted, the operation being repeated often enough, the dyes may ultimately be separated from each other. This process forms the basis of the author's extensive work on the above subject, in the course of which he deals with various kinds of capillary media (including plant stems) and various dissolved substances. J. C. P.

Stability of Potassium Tetraoxalate and Sodium Oxalate. By DUPRÉ, jun., and A. VON KUPFFER (*Zeit. angew. Chem.*, 1902, 15, 352—353).—Sodium oxalate, although difficult to procure in an absolutely pure condition, is preferable in volumetric analysis to potassium tetraoxalate which, according to the authors, suffers gradual deterioration by exposure to the air. L. DE K.

Estimation of Oxygen and Carbon Dioxide in Small Quantities of Blood. By JOSEPH BARCROFT and JOHN S. HALDANE (*J. Physiol.*, 1902, 28, 232—240).—The apparatus used is fully described and figured, and gives accurate results even although only about 1 c.c. of blood is used. It consists of a small glass vessel attached by tubing to a pressure gauge of narrow bore. It is so arranged that the oxygen in the blood can be liberated within it by potassium ferri-cyanide. By similar manipulation, with the use of tartaric acid instead

of ferricyanide, the carbon dioxide is subsequently liberated. In each case, the resulting increase of pressure is measured by the gauge, and from this the volume is calculated.

W. D. H.

**Colorimetric Estimation of Sulphur in Pig-Iron.** By W. G. LINDLAY (*Chem. Centr.*, 1902, i, 779; from *School of Mines Quarterly*, 23, 24).—Five grams of the sample are dissolved in hydrochloric acid, and the hydrogen sulphide is absorbed in aqueous sodium hydroxide. The alkaline solution is diluted to 250 c.c., and 5 c.c. of this are mixed in a Nessler tube with 1.5 c.c. of dilute sulphuric acid, 0.1 c.c. of a 2 per cent. solution of *p*-phenylenedimethyldiamine hydrochloride, and 0.05 c.c. of 10 per cent. ferric chloride. The mixture will assume a more or less strong blue colour due to methylene-blue. After 30 seconds, the colour is compared with solutions to which have been added 0.1, 0.2, or 0.3 c.c. of a solution of sodium sulphide containing 0.05 gram of sulphur per litre. Or a standardised solution of methylene-blue may serve as comparison liquid.

L. DE K.

**Estimation of Sulphur in Plants.** By GEORGE S. FRAPS (*J. Amer. Chem. Soc.*, 1902, 24, 346—348).—The following method is recommended. Five grams of the material are cautiously heated in a porcelain basin on the water-bath with 20 c.c. of concentrated nitric acid. As soon as all danger of frothing over has passed, the mixture is partially evaporated, 10 c.c. of a 5 per cent. solution of potassium nitrate are added, and the evaporation is continued to dryness. The residue is ignited, at first gently, and afterwards over a blast-lamp, until it becomes white. It is then dissolved in hydrochloric acid, evaporated to dryness, and heated for some time in an air-bath to render the silica insoluble. The residue is taken up with acidified water, filtered, and the sulphuric acid in the filtrate precipitated with barium chloride as usual. Igniting the plants in the presence of calcium acetate gave too low results.

W. P. S.

**A New Method for Titrating Free and Combined Sulphuric Acid.** By WOLF MÜLLER (*Ber.*, 1902, 35, 1587—1589).—A solution of benzidine hydrochloride is prepared by dissolving about 30 grams of the purified salt in a litre of water containing hydrochloric acid, and its acidity determined by titration against a standard solution of baryta or an alkali hydroxide, using phenolphthalein as indicator; as the salt is hydrolysed in aqueous solution, the acidity so determined is a measure of both the free and combined acid. An excess of the benzidine solution is then added to the hot solution, containing sulphuric acid or sulphate, to be estimated, when the whole of the latter is precipitated in the form of insoluble benzidine sulphate; the diminution in the total acidity of the mixture, determined by titrating an aliquot portion of the filtrate with the standard alkali, gives a measure of the benzidine removed, and hence also of the sulphuric acid precipitated. Results are given which show the degree of accuracy of the method, and indicate that the presence of hydrochloric or nitric acid is without prejudice to its use.

W. A. D.

**Kjeldahl's Method.** By CARL NEUBERG (*Beitr. chem. Physiol. Path.*, 1902, 2, 214—215).—The addition of sodium or potassium sulphide in fresh aqueous solution increases the volume of the liquid to be distilled and prolongs the process. Solid sodium thiosulphate is therefore recommended instead. The decomposition which occurs with the amido-mercuric sulphate is represented by the following equation:  $\text{Hg}(\text{NH}_3)_2\text{SO}_4 + \text{Na}_2\text{S}_2\text{O}_3 + \text{H}_2\text{O} = \text{HgS} + (\text{NH}_4)_2\text{SO}_4 + \text{Na}_2\text{SO}_4$ . Control experiments show that the results obtained are identical with those obtained when an alkali sulphide is employed. W. D. H.

**A Nitrogen Apparatus.** By JOHN A. WESENER (*J. Amer. Chem. Soc.*, 1902, 24, 388—390).—The apparatus described is an arrangement or battery of distilling flasks for use in Kjeldahl's nitrogen process. The digestion with sulphuric acid is carried out in the same flask as is used for the distillation of the ammonia. A current of steam is employed to expel the latter. W. P. S.

**Estimation of Nitrogen in Urine Treated with Phosphotungstic and Hydrochloric Acids.** By WILLIAM CAMERER, sen. (*Zeit. Biol.*, 1902, 43, 67—85).—A critical and polemical discussion of methods of estimating urinary nitrogen. W. D. H.

**Commercial Liquor Ammoniae, its Effect on Iron, its Impurities, and Methods for Estimating them.** By J. D. PENNOCK and D. A. MORTON (*J. Amer. Chem. Soc.*, 1902, 24, 377—388).—As the result of numerous experiments, it is stated that concentrated ammonia solution (28 to 28.5 per cent. of  $\text{NH}_3$ ) does not rust clean iron, and that it actually prevents its rusting, even in the presence of water, oxygen, or ammonium carbonate. The presence of free carbon dioxide is necessary for rusting to take place. Freshly rusted moist iron is acted on by concentrated ammonia solution, and the rusting continues for some considerable time, this being probably due to the rusty coat containing ferrous hydrogen carbonate. Old rusted iron is not attacked, the coat being ferric oxide and not ferrous hydrogen carbonate.

The impurities usually found in commercial liquor ammonia are carbon dioxide, tarry organic matter, and pyridine. The first may be determined by boiling 100 c.c. with a measured volume of *N* sodium hydroxide, precipitating the carbon dioxide with barium chloride, and filtering off the barium carbonate. The latter is then titrated in the usual way. Another method is to evaporate 100 c.c. of the ammonia solution down to about 20 c.c., after the addition of 5 c.c. of *N* sodium hydroxide. Fifty c.c. of cold boiled water, and a few drops of phenolphthalein solution are then added, the solution is cooled to 10°, and made neutral by running in *N*-acid until the last trace of pink colour is removed. Excess of *N*/10 sulphuric acid is then added, the solution boiled, and titrated back with *N*/10 sodium hydroxide. The amount of carbonate in the sodium hydroxide solution added in both methods must be separately estimated and allowed for. The organic (tarry) matter is estimated by boiling with *N*/50 potassium dichromate after making the solution



acid with dilute sulphuric acid. The excess of dichromate is then titrated back with standard ferrous sulphate solution. Pyridine is estimated by neutralising a known volume (100 c.c.) of the ammonia with sulphuric acid, using methyl-orange as indicator, and keeping the solution cool. The neutral mixture is then distilled. All the pyridine comes over in 70 c.c., the distillate being collected in 30 c.c. of cold water. Some ammonia also comes over and is removed by the addition of mercuric chloride to the distillate, using phenolphthalein as indicator. The latter is not coloured by pyridine, so that the pink colour is just removed when all the free ammonia has been combined. The solution is then filtered and titrated after the addition of a few drops of methyl-orange solution.

A table is given showing the percentage of ammonia in aqueous ammonia corresponding with any reading of the Baumé hydrometer between 24° and 27° at any temperature between 10° and 30°.

W. P. S.

**The Brucine Reaction for Nitrous Acid.** By GEORG LUNGE (*Zeit. angew. Chem.*, 1902, 15, 241—242. Compare this vol., ii, 288).—A further reply to Winkler (this vol., ii, 353). The author now acknowledges that when using a moderate amount of sulphuric acid the brucine reaction is also given by nitrous acid.

L. DE K.

**Reinsch's Test for Arsenic.** By EDGAR B. KENRICK (*J. Amer. Chem. Soc.*, 1902, 24, 276).—In the centre of a piece of sheet copper, a depression is punched one-eighth of an inch deep and of the same diameter. The arsenic is deposited, as usual, on a piece of copper a few mm. in area. When dry, this is placed in the miniature crucible, which is then covered with a microscope cover glass cooled with a drop of water; a gentle flame is applied to sublime the arsenic. The cover glass is then microscopically examined for crystals of arsenious oxide, using a high power and proper illumination.

L. DE K.

**Common Errors in the Estimation of Silica.** By WILLIAM F. HILLEBRAND (*J. Amer. Chem. Soc.*, 1902, 24, 362—374).—The author confirms the statements of former investigators (see Abstr., 1894, ii, 366) that the methods in common use for rendering silica insoluble cannot be depended on. Silica is not rendered wholly insoluble by any number of evaporations with hydrochloric acid when followed by a single filtration, whatever the temperature employed may be. Two or more evaporations with intervening filtrations are necessary. Any silica which may pass into the filtrate in the presence of much aluminium or iron is not completely thrown down by ammonia or sodium acetate. Silica is also appreciably soluble in fused potassium pyrosulphate. The author also finds that ignition over the blast is needed to get the correct weight of the silica obtained.

W. P. S.

**Estimation of Carbon in the Presence of Osmium.** By GEORG VON KNORRE (*Zeit. angew. Chem.*, 1902, 15, 393—394).—The weighed substance (carbon-osmium fibre) is placed in a porcelain boat and

ignited inside a combustion tube in a current of oxygen. The gases evolved are freed from vapours of osmium tetroxide by passing them through a 150—200 c.c. Erlenmeyer flask containing 100 c.c. of a solution of ferrous sulphate (1:10) slightly acidified with sulphuric acid. As it is necessary to finally heat the solution to boiling to expel any dissolved carbon dioxide, the flask is attached to a reflux apparatus.

The carbon dioxide is, as usual, dried over calcium chloride and absorbed in a weighed potash apparatus.

L. DE K.

**A New Form of Alkalimeter.** By CHARLES B. DAVIS (*J. Amer. Chem. Soc.*, 1902, 24, 391—392).—The apparatus consists essentially of two conically shaped vessels, the bottom of one fitting into the top of the other by means of a ground-in joint. The upper flask is divided by a vertical partition into two chambers which are provided at top with glass stoppers. One chamber is filled with water and has at its lower end a bent capillary tube through which the water runs into the lower flask when the stopper is removed. The substance (carbonate) is weighed into the lower flask together with 1 gram each of salicylic and benzoic acids, the upper flask is fitted on, and after again weighing, the water is allowed to flow into the lower flask by removing the stopper of the water chamber. The liberated carbon dioxide passes through two bent capillary tubes in the second chamber of the upper flask, which has previously been partly filled with concentrated sulphuric acid. When the action is over, dry air, freed from carbon dioxide, is drawn through the apparatus, and the latter is again weighed to obtain the loss of weight due to carbon dioxide.

W. P. S.

**Estimation of Lithia in Lepidolite.** By W. J. SCHIEFFELIN and W. R. LAMAR (*J. Amer. Chem. Soc.*, 1902, 24, 392—395).—The gently ignited chlorides of the alkalis, obtained in the usual way, are dissolved in 10 c.c. of hot water and 1 drop of hydrochloric acid. A little ammonia and ammonium oxalate are added and the solution is filtered into an Erlenmeyer flask of about 80 c.c. capacity. The contents of the flask are evaporated until crystallisation begins to take place (the volume will then be 1 or 2 c.c.); a few drops of water and hydrochloric acid are added and then 15 c.c. of amyl alcohol (b. p. 129—132°). The water is very cautiously boiled off and the volume of the amyl alcohol concentrated to about one-half. After cooling, the solution is filtered into a weighed platinum basin, and the residue is washed with amyl alcohol until free from lithia. The amyl alcohol is then evaporated off at a temperature below its boiling point. The residue in the basin is finally converted into sulphate, ignited, and weighed. Rubidium and caesium chlorides are practically insoluble in amyl alcohol.

W. P. S.

**Micro-chemical Reactions of Magnesium and Characterisation of Magnesium Ammonium Mellate.** By M. EMM. Pozzi-Escot (*Ann. Chim. anal.*, 1902, 7, 126—128).—In order to obtain a characteristic precipitate of ammonium magnesium phosphate for microscopical

purposes, two solutions are recommended: *A*, One gram of microcosmic salt, 4 grams of ammonium chloride, 2 grams of citric acid, 6 grams of ammonia, and 250 grams of water; *B*, 1 gram of microcosmic salt, 4 grams of ammonium chloride, 4 grams of citric acid, 10 grams of ammonia, and 250 grams of water.

When precipitated by *A*, the triple phosphate has the form of prisms with truncated edges. With *B*, the crystals are in the form of trapeziums or octahedrons.

By mixing an ammoniacal solution of a magnesium salt with ammonium mellate and concentrating the solution, crystals of ammonium magnesium mellate are formed which under the microscope have the appearance of large prisms the edges of which resemble enormous bacilli, or of long and slender prisms, the whole looking very much like potassium-palladium nitrite (*Abstr.*, 1900, ii, 271).

L. DE K.

**Rational Analysis of Clays.** By ALEXANDER SABECK (*Chem. Centr.*, 1902, i, 779—780; from *Chem. Ind.*, 25, 90—99).—Five grams of the sample are heated in a covered porcelain basin with 100 c.c. of water and 50 c.c. of sulphuric acid, the gas flame being at some distance from the bottom. In the presence of much organic matter, 15 c.c. of nitric acid are also added. The heating is discontinued when fumes of sulphuric acid are being given off, which is generally the case after about 4 hours. After diluting with water, the liquid is poured into a large beaker and the residue boiled for 5 minutes with 10 c.c. of a 33 per cent. solution of sodium hydroxide which is then also decanted into the beaker; the undissolved matter is treated several times in succession with 5 c.c. of hydrochloric acid, and with 10 c.c. of the alkali. The residue is finally brought on to a filter by means of dilute hydrochloric acid. The clear liquid in the beaker is carefully decanted and the remaining 50—100 c.c. which contain deposit are returned to the basin and subjected to the alternate treatment with acid and alkali, the clear acid and alkaline washings being, however, collected separately. Every particle of undissolved matter is finally collected on the same filter, which is then burnt in a weighed platinum dish. In the ash, quartz and felspar are separated by Seeger's method. The results are satisfactory for technical purposes.

L. DE K.

**Volumetric Estimation of Iron.** By WILHELM H. GINTL (*Zeit. angew. Chem.*, 1902, 15, 398—402, 424—434).—A review of the various methods proposed for the volumetric estimation of iron.

The following process is recommended by the author. The ferric solution is acidified with sulphuric acid, and introduced into a flask fitted with a Bunsen valve, and reduced by means of a spiral of palladium which has been charged with hydrogen either by heating it in a current of this gas at 100° or by electrolytical means. After heating for 1 hour and a half on the water-bath and cooling, the spiral (the end of which protrudes from the liquid) is withdrawn and the solution at once titrated with permanganate.

L. DE K.

**Estimation of Manganese in Iron.** By WILLIAM A. NOYES and G. HARRY CLAY (*J. Amer. Chem. Soc.*, 1902, 24, 243—245).—The reagents required are: a solution of ferrous ammonium sulphate containing 8.56 grams of this salt and 40 c.c. of 25 per cent. solution of sulphuric acid per litre, a solution of potassium permanganate, 1 c.c. of which represents 0.001 gram of iron or 0.0049 gram of manganese, and a solution made by dissolving 30 grams of crystallised sodium acetate in 30 c.c. of 30 per cent. acetic acid and 170 c.c. of water.

1.5 grams of the sample of iron are dissolved in 25 c.c. of nitric acid of sp. gr. 1.2, or 20 c.c. of this acid and 5 c.c. of hydrochloric acid of sp. gr. 1.2. After nearly neutralising the liquid with solution of sodium carbonate, an emulsion of zinc oxide is added until the iron begins to precipitate, and after 2 minutes an excess of zinc oxide is added. The whole is now diluted to 300 c.c., and 200 c.c. (= 1 gram of the sample) are mixed in a beaker with 20 c.c. of the sodium acetate solution and 40 c.c. of saturated bromine water. On boiling, the manganese separates as dioxide, which is then collected on a filter and washed. It is dissolved off the filter by means of 20 c.c. of the iron solution, and after thoroughly washing the filter, the filtrate is titrated with permanganate. The usual check is made and the difference in c.c. of permanganate represents the manganese. L. DE K.

**Volumetric Estimation of Molybdenum Steel.** By FRANCIS T. KOPP (*J. Amer. Chem. Soc.*, 1902, 24, 186—188).—About half a gram of the sample is dissolved in 2 c.c. of sulphuric acid of sp. gr. 1.58 and 12 c.c. of water; in the case of ferromolybdenum, this is dissolved in 12 c.c. of strong nitric acid followed by 2 c.c. of sulphuric acid. After evaporating until sulphuric acid fumes appear, 30 grams of fused potassium hydrogen sulphate are added, and the whole is fused for 15 minutes at a bright red heat. The fused mass is then dissolved in 500 c.c. of hot water, the liquid transferred to a litre flask, 100 c.c. of ammonia of sp. gr. 0.9 are added, and the whole made up to the mark. Five hundred c.c. of the filtrate are then mixed with 40 c.c. of sulphuric acid of sp. gr. 1.58 run through a Jones's zinc reductor, mixed with another 10 c.c. of sulphuric acid, and titrated with permanganate solution (1 c.c. = 0.003053 gram of iron). After allowing for impurities in the reagents, the molybdenum is found by multiplying the result by 0.71776.

When tungsten is present, 1 gram of the sample is dissolved in 25 c.c. of nitric acid of sp. gr. 1.20, 10 c.c. of hydrochloric acid are added, and the silica is rendered insoluble as usual. The dry mass is dissolved in 15 c.c. of hot hydrochloric acid, which will precipitate the tungsten as trioxide; when cold, the liquid is diluted to 100 c.c. and 50 c.c. of the filtrate are evaporated with 10 c.c. of sulphuric acid. The residue is then fused with 30 grams of potassium hydrogen sulphate as previously directed. L. DE K.

**Estimation of Molybdenum in Steel.** By GEORGE AUCHY (*J. Amer. Chem. Soc.*, 1902, 24, 273—275).—1.308 grams of the sample are dissolved in a large excess of nitric acid with addition of a little



potassium chlorate, the nitric acid is completely expelled by boiling and evaporation with hydrochloric acid, and the mass dried to render silica insoluble; a fresh quantity of hydrochloric acid is added and the solution evaporated until a scum begins to form. Five c.c. of hydrochloric acid diluted to 20 c.c. with water are now added and the mixture is heated until complete solution has taken place, when it is diluted to 50 c.c. The (filtered) solution is now slowly poured into a 300 c.c. flask containing 100 c.c. of water and 20 grams of sodium hydroxide, well shaken, and made up to the mark. After settling and filtering, 200 c.c. of the filtrate are collected, boiled down to 100 c.c., acidified with sulphuric acid, reduced with zinc, and titrated with permanganate. It is very important to make a blank test with steel free from molybdenum but containing the same amount of chromium as the sample, and to be careful to use exactly the same amount of hydrochloric acid.

L. DE K.

**Estimation of Thorium in Monazite-sand.** By EMIL BENZ (*Zeit. angew. Chem.*, 1902, 15, 297—309).—A review of the various methods used in the analysis of monazite-sand. The following process is finally recommended.

0.5 gram of the finely divided sample is mixed in a platinum crucible with 0.5 gram of sodium fluoride and then slowly fused with 10 grams of potassium pyrosulphate, the crucible being covered with a lid. When evolution of gas ceases, a faint red heat is applied for about 15 minutes, and when cold the mass is extracted with warm dilute hydrochloric acid. After filtering, the undissolved mass is boiled with a little strong acid, diluted with water, and again filtered. The mixed filtrate, measuring about 300 c.c., is partially neutralised with ammonia and then precipitated while boiling by adding 3—5 grams of solid ammonium oxalate. After remaining overnight, the precipitate is collected and the thorium estimated as follows. The oxalates are converted into nitrates by evaporation with fuming nitric acid, the residue is dissolved in 50 c.c. of water containing at most 1 c.c. of dilute nitric acid (1 : 10) and precipitated at 60—80° by adding 10 c.c. of hydrogen peroxide. The thorium peroxide is then converted by ignition into the oxide and weighed. A mere trace of cerium may be present which may be estimated colorimetrically.

L. DE K.

**Separation of Thorium.** By FLOYD J. METZGER (*J. Amer. Chem. Soc.*, 1902, 24, 275—276).—Preliminary experiments have shown that thorium may be quantitatively separated from cerium, lanthanum, or didymium by a double precipitation in a 40 per cent. alcoholic solution with fumaric acid. The application of the process to monazite will be tried, also the effect of other weak organic acids.

L. DE K.

**Estimation of Vanadium.** By DAVID T. WILLIAMS (*J. Soc. Chem. Ind.*, 1902, 21, 389—390).—From 1—2 grams of the ore are treated with about 6 c.c. of nitric acid until thorough decomposition has taken place. The solution is then evaporated to dryness, the residue heated with 4 c.c. of sulphuric acid to expel all nitric acid, diluted with hot water, and boiled. The lead sulphate is removed by

filtration, the filtrate is oxidised with 4 c.c. of nitric acid, and well boiled. After making alkaline with ammonia and re-acidifying with dilute sulphuric acid, the solution is cooled to 40° and titrated with a decinormal ferrous sulphate solution containing free sulphuric acid, using potassium ferricyanide as indicator. The amount of vanadium is found by multiplying the iron value of the ferrous sulphate solution by 0.914.

In the case of alloys, 0.5 gram is dissolved in *aqua regia* and evaporated with sulphuric acid as above. Copper has no detrimental effect on the analysis.

W. P. S.

**The Peroxide Calorimeter as applied to European Coals and Petroleum.** By SAMUEL W. PARR (*J. Amer. Chem. Soc.*, 1902, 24, 167—171).—Sodium peroxide is not a sufficiently strong oxidiser for the combustion of European coals or petroleum, but this can be remedied by the addition of potassium persulphate and tartaric acid. 0.5 gram of dried coal is mixed by means of a wire with 1.5 grams of a mixture of potassium persulphate and tartaric acid (2:1); to the whole is then added 12 grams of sodium peroxide. A blank experiment is made to ascertain the amount of heat developed by the oxidising mixture alone.

In the case of petroleum, 3 grams of sodium peroxide are introduced into the cartridge and on this is dropped 1/3 of a gram of petroleum, using a dropping pipette from a light weighing flask, the exact weight of the oil being found by difference. To this is now added 1.5 grams of the mixture of potassium persulphate and tartaric acid and the whole is well stirred with a wire so as to have an even mixture. Twelve grams of sodium peroxide are now added and the whole, after being well shaken, is ready for ignition by means of a hot soft iron wire, as usual. After allowing for the heat developed by the oxidising mixture, 73 per cent. of the remainder is due to heat of combustion and 27 per cent. to heat of combination of the chemical products.

L. DE K.

**Estimation of Essential Oils in Spices.** By CARL MANN (*Arch. Pharm.*, 1902, 240, 149—166).—The apparatus employed is figured in the paper. The spice is powdered coarsely and 20 grams of it are mixed with half the weight of coarsely powdered pumice and placed in a sort of test-tube. This tube has some perforations below and is fixed in the cork of a wider tube, which contracts below to a narrower tube which is fitted to a tin can serving as a boiler. The upper part of the test-tube is fitted with a drop-catcher still-head and connected with a long condenser. When the boiler is heated, the steam jackets the tube containing the spice and heats it; at the same time it blows through the perforations and carries with it into the condenser the oil contained in the spice. The distillation is continued until no more oil comes over; this requires  $1\frac{1}{2}$ — $2\frac{1}{2}$  hours. The distillate, which amounts to 400—900 c.c., is collected in a flask of 1— $1\frac{1}{2}$  litres capacity, the neck of which is graduated at intervals of 25 c.c. It is shaken with a quarter of its weight of salt freed from impurities insoluble in water; when this has dissolved, 50 c.c. of “rhigolene” are

added (a light petroleum fraction boiling at 20—35°, obtained by fractionating "naphtha"); the whole is shaken for half-an-hour, and set aside 2 hours to settle. Distilled water is added cautiously until the aqueous solution reaches the lowest mark in the neck, and "rhigolene" added to replace the unavoidable loss by evaporation and make the layer of it reach to the mark 50 c.c. above. Half of this layer is removed with a 25 c.c. pipette to a conical flask, which has a side tube and a tube ground in at the neck, each fitted with a stopcock. Dried air is aspirated through this flask by means of a water-pump until the air expelled from the pump, which is driven over calcium chloride and then through a fine platinum jet against the top of a small bunsen flame, ceases to produce a small, luminous cone by its burning. The stopcocks are then closed, and the residual essential oil is weighed; its weight multiplied by ten gives the percentage of oil in the spice. Control experiments showed that on the average 0.0137 gram of oil is lost for every 0.5 gram that is weighed; this may be added as a correction.

The method was compared with those commonly employed for the estimation of eugenol (as benzoyleugenol), of benzaldehyde (as benzylidenephénylhydrazine), and of mustard oil (as silver sulphide, from the thiosinamine first formed); the results were satisfactory. Estimations of the essential oil in several spices were made in this way, in each case in duplicate; the difference between two corresponding estimations amounted usually to 1—4 per cent. of the whole amount of the oil, in one or two cases to 10—15 per cent.

For liqueurs, a similar method may be used. If only alcohol, water, and sugar are present in addition to the essential oil, 100 c.c. of the liqueur are diluted with five times the amount of water, the mixture saturated with salt, and extracted with 50 c.c. of rhigolene, the extract being treated as above. If resins, fats, chlorophyll, or "extractive substances" are present, the distillation apparatus is employed, the tube of it being packed with a mixture of purified cellulose, with half its weight of pumice, and 25 c.c. of the rhigolene extract run upon this; in the distillation, the resins, &c., remain in the cellulose.

For perfumed soaps, 20 grams, in fine shavings, are dissolved in 150 c.c. of water and 20 grams of 90 per cent. alcohol in a conical flask fitted to a reflux apparatus. The solution is cooled, neutralised accurately with dilute sulphuric acid, of which 1 drop is then added in excess, and saturated with salt; about 1.5 gram of tannin is added and a few small lumps of pumice, and the liquid is heated gently and steam blown through it in such a way that the volume is kept constant; the distillate is treated as already described.

For perfumes, the same method may be employed as for liqueurs, except that a smaller quantity, 5—10 grams, may be taken.

C. F. B.

**Chemical Analysis of Wine.** By MAURICE BERNARD (*Chem. Centr.*, 1902, i, 784; from *Pharm. Zeit.*, 47, 140).—The author recommends the following method as a rapid means of deciding whether wines may pass as genuine or ought to be detained for further investigation.

The extract is determined by the official (German) method. The total acidity is determined by titrating 25 c.c. of the sample with  $N/4$  potassium hydroxide, using azolitmin paper as indicator. The neutralised wine is then evaporated to 10 c.c., decolorised with animal charcoal, filtered, and again made up to 25 c.c. Twenty c.c. of this are then boiled for 3 minutes with excess of diluted Fehling's solution, the precipitated cuprous oxide is collected, washed, and dissolved in a little dilute nitric acid; after removing the acid by means of urea, potassium iodide is added, and the iodine set free by the copper solution is titrated as usual and calculated to invert sugar. For the estimation of the fixed acidity and the sucrose, 25 c.c. of the wine are evaporated nearly to dryness, the residue is redissolved in water, and titrated as before. The solution is now fully inverted by heating for 20 minutes on the water-bath with addition of 2 c.c. of 1 per cent. hydrogen chloride solution; the sugar is then again estimated. When determining the ash, it should be moistened a few times with water and gently re-ignited.

L. DE K.

**Estimation of Methoxyl with the Aid of Gregor's Washing-liquid.** By J. MOLL VAN CHARANTE (*Rec. Trav. Chim.*, 1902, 21, 38—41).—It is found that the use of a solution of arsenious oxide in aqueous potassium carbonate (Gregor, *Abstr.*, 1898, ii, 490), in place of the suspension of red phosphorus in water, recommended by Zeisel in the estimation of methoxyl groups, leads to loss of methyl iodide. Thus, in an analysis of methylglucoside, from 1 to 6 per cent. too little methoxyl was found by Gregor's method, whereas Zeisel's gave quite accurate results.

K. J. P. O.

**Estimation of Sugars in the Blood.** By RAPHAEL LÉPINE and BOULUD (*Compt. rend.*, 1902, 134, 398—400).—Extracts of blood are first examined by the polarimeter, and its reducing action on cupric salts is also estimated. A second estimation is made after the same extract has been heated at  $100^{\circ}$  for 3 minutes to destroy the combinations of glycuronic acid; a third estimation is made after fermentation with yeast, and a fourth after the action of invertin. Examples are given of the results obtained.

W. D. H.

**Colour Test for Wood-fibre.** By ALBERT KAISER (*Chem. Zeit.*, 1902, 24, 335).—Equal volumes of amyl alcohol, free from furfuraldehyde, and sulphuric acid are heated at  $90^{\circ}$  until there is a slight evolution of gas, and the reddish-green product is then cooled. Pure filter paper, when moistened with this reagent, turns red or violet, but paper containing wood-pulp turns first green and then a fine blue. The test is accelerated by gently warming in a current of air.

The colour is due to the formation of furfuraldehyde from the wood-pulp, which then gives Vitali's reaction with amyl-sulphuric acid.

L. DE K.

**Quantitative Separation of Hydrochloric and Hydrocyanic Acids.** By THEODORE W. RICHARDS and SIDNEY K. SINGER (*Amer. Chem. J.*, 1902, 27, 205—209).—The process given by the authors is



well adapted for the estimation of chlorides in commercial potassium cyanide. About 1.25 grams of the salt are dissolved in 400 c.c. of water and the solution placed in an untubulated 500 c.c. retort with its neck directed upward at an angle of  $45^{\circ}$ . The volume of the liquid should not be allowed to fall below 300 c.c. After adding 5 c.c. of sulphuric acid and boiling for 8 to 9 hours, all the hydrocyanic acid is expelled and the hydrochloric acid is then estimated in the residual liquid by means of silver nitrate.

If the amount of chlorine is very trifling, a 2 hours' boiling suffices. If it is desired to also estimate the hydrocyanic acid, the most convenient way would probably be to precipitate it as silver cyanide, allowing for the silver chloride precipitated at the same time.

L. DE K.

**Direct Titration of Uric Acid in Urine.** By I. RUHEMANN (*Chem. Centr.*, 1902, i, 784—785; from *Berl. Klin. Woch.*, 1901, 39, 27—29, 55—58).—The apparatus termed "Urikometer," consists of a glass tube carrying three marks. Carbon disulphide (about 20 drops) is added up to the first mark, and a solution containing 1.5 grams of iodine and 1.5 grams of potassium iodide dissolved in 15 grams of alcohol and 185 grams of water is added up to the second mark; the amount of iodine thus introduced equals 0.015 gram. The space between the second and third marks is occupied by a scale showing the quantity of uric acid per 1000 parts of urine. The sample to be tested is now added little by little with thorough shaking until the free iodine has been all absorbed as shown by the final bleaching of the carbon disulphide, and when the foam has subsided the scale is read off. In constructing this scale, urines have been used the uric acid of which was previously determined by means of the gravimetric (hydrochloric acid) method. The urine should be acid, and must be made so, if necessary, by addition of acetic acid, and albuminous matters should be precipitated by boiling. Urines very rich in uric acid must be suitably diluted; if very poor in acid, a weaker iodine solution must be employed.

L. DE K.

**Assay of Crude Cream of Tartar.** By P. CARLES (*Ann. Chim. anal.*, 1902, 7, 121—123).—Chancel's "casserole process" gives results which are sufficiently accurate for technical purposes, provided the temperature is kept for 12 hours at  $15^{\circ}$ ; 1 litre of mother liquor then retains 5 grams of potassium hydrogen tartrate. When the temperature is different, the amount of dissolved matter also varies. Correction must be made for the solubility of potassium hydrogen tartrate in water. At  $0^{\circ}$ ,  $5^{\circ}$ ,  $10^{\circ}$ ,  $15^{\circ}$ ,  $20^{\circ}$ ,  $25^{\circ}$ , and  $30^{\circ}$ , 1 litre of water dissolves respectively 3.2, 3.6, 4.0, 5, 5.7, 7.35, and 9 grams of this salt.

L. DE K.

**Relation of the Heat of Combustion to the Specific Gravity in Fatty Oils.** By H. C. SHERMAN and J. F. SNELL (*J. Amer. Chem. Soc.*, 1902, 24, 348—353).—The determinations of the heat of combustion and sp. gr. of the oils mentioned in the previous paper (*Abstr.*, 1901, ii, 431) have been repeated. The results show that in

fresh fatty oils the heat of combustion is a property quite as constant as the sp. gr., to which it bears a definite relation. Oxidation resulting from exposure to air decreases the heat of combustion to the same extent that it increases the sp. gr., whence it is inferred that the oxygen is taken up by direct addition and without essential change in the volume of the oil. On account of its close quantitative relations to the sp. gr. and ultimate composition, the heat of combustion is a useful factor in the study of the fatty oils. E. G.

**Temperature Reaction of Oils with Sulphuric Acid—Mau-mené's Test.** By H. C. SHERMAN, J. L. DANZIGER, and L. KOHNSTAMM (*J. Amer. Chem. Soc.*, 1902, 24, 266—273).—An acid is taken containing only 89—90 per cent. of hydrogen sulphate and this may be used for every kind of drying oil without having to employ diluents. The rise in temperature is multiplied by 100 and divided by the rise obtained with water as already proposed by Thomson and Ballantyne (*Abstr.*, 1892, ii, 547), the result being the specific temperature reaction.

The results obtained by the authors are a little lower than those obtained by Thomson and Ballantyne, although in the case of a few animal oils they are somewhat higher. The average figures are, for raw linseed oil 299, poppyseed oil 212, maize oil 163, cottonseed oil 152, rape oil 150, arachis oil 161, sesamé oil 143, almond oil 95, olive oil 90, castor oil 84, menhaden oil 333, cod-liver oil 270, seal oil 255, lard oil 85, sperm oil 102, and rosin oil 72. L. DE K.

**A Comparison of Methods Used to Determine the Iodine Values of Oils.** By F. W. HUNT (*J. Soc. Chem. Ind.*, 1902, 21, 454—456).—The conclusion arrived at is that the Hübl method can be replaced by either the Wijs (iodine trichloride dissolved in glacial acetic acid) or Hanuš (iodine monobromide dissolved in glacial acetic acid) processes. The Hanuš solution gave figures slightly higher than the Hübl figures in the case of fish oils, but not so high as those of Wijs. With seed oils, the results of all three methods agree closely. The use of carbon tetrachloride as a solvent in place of glacial acetic acid is not recommended. The Hanuš and Wijs solutions keep well, but with a slight decrease in strength. W. P. S.

**Use of the Bechi or Silver Nitrate Test with Olive Oils.** By L. M. TOLMAN (*J. Amer. Chem. Soc.*, 1902, 24, 396—397).—As nearly all olive oils give a brown coloration with the Bechi test, the author purifies the oil as follows before applying the test. Twenty-five c.c. of the oil are mixed with 25 c.c. of alcohol (95 per cent.), shaken, and gently heated. When the liquids have separated, the alcohol is removed, and the oil is then washed with 2 per cent. nitric acid and finally with water. Cotton-seed oil when so treated reacts with undiminished strength, whilst pure olive oils, which previously gave a brown colour, showed no reduction. W. P. S.

## General and Physical Chemistry.

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**Refraction of Normal Salt Solutions.** By CARL BENDER (*Ann. Physik.*, 1902, [iv], 8, 109—122. Compare Abstr., 1899, ii, 621; 1900, ii, 461).—The previous investigations have been extended to sodium chloride solutions of  $N/2$ ,  $N$ ,  $2N$ ,  $3N$ ,  $4N$ , and  $4.5N$  concentration, and interpolation formulæ are given expressing the relation of the index of refraction to the temperature. These curves approach more and more the form of a straight line with rising temperature and increasing concentration. The dispersion, as measured by  $H_\gamma - H_\alpha$ , decreases somewhat as the temperature rises. The molecular refraction (Lorenz) of sodium chloride for the sodium line is found to be 9.273, whence the atomic refraction of sodium is calculated to be 3.493. Assuming that the density of sodium at  $15^\circ$  is 0.985, this would give 1.23601 as the index of refraction of metallic sodium for the sodium line.  
J. C. P.

**The Constitution of Matter and Spectroscopy.** By B. EGINITIS (*Compt. rend.*, 1902, 134, 1137—1139).—The author's observations, combined with those of Schuster (*Phil. Trans.*, 1899, 193, 189) and Hemsalech, lead to the conclusion that the intensities of the different lines of a metal depend on the nature of the other metals with which it is mixed and on the nature of the medium across which the electric discharge takes place. Some lines of simple metals form groups, the variations in which are probably due to the variations in the constitution of the radiating particles and in the nature of the poles. There seems to be a relation between these groups and the groups of lines that have the same velocity. During the discharges, the metallic vapours show electrical properties which vary with the nature of the vapours and differ considerably from those of air. The utilisation of self-induction in electrical discharges across gases constitutes a method for examining the constitution of matter.  
C. H. B.

**Nature and Constitution of the Spectra of the Aurora Borealis.** By HENRI STASSANO (*Ann. Chim. Phys.*, 1902, [vii], 26, 40—57).—The predominant rays of the spectra of the aurora borealis and the solar prominences are due to neon, argon, helium, and hydrogen, the luminosity being caused by those gases which are most volatile and the best conductors of electricity at temperatures near  $-200^\circ$  under very greatly diminished pressure (compare Liveing and Dewar, Abstr., 1901, ii, 213).  
G. T. M.

**A Simple Trough for Light-Filters.** By CHR. WINTHER (*Ber.*, 1902, 35, 1976—1977).—A block of wood ( $6 \times 6 \times 2$  cm.) is pierced by a cylindrical hole (3 cm. diameter) and also drilled from one edge to the centre. These holes are well lined with pitch, and plates of glass are then cemented with pitch to the sides of the block. The cylin-

dricul trough is filled through the narrow hole, which is then closed by a paraffined cork. The troughs can be used for acid solutions, but not for alcohol or benzene.

T. M. L.

**Formation of Negative Images by the Action of Certain Vapours.** By P. VIGNON (*Compt. rend.*, 1902, 134, 902—904).—It has been shown by Colson (*Abstr.*, 1896, ii, 601) that vapours emitted from zinc are capable of acting on a photographic plate. The author has obtained images of medals, &c., powdered over with zinc dust, by mere contact with the photographic plate. Although such images are not perfectly sharp, presenting the appearance of being viewed through a gauze screen, yet they are vigorous. Negatives have also been obtained by the action of ammoniacal vapours on linen treated with a mixture of powdered aloes and olive oil. A gloved plaster hand moistened with ammonium carbonate leaves, on this account, a photographic imprint on such linen.

L. M. J.

**The New Gas from Radium.** By E. RUTHERFORD and Miss H. T. BROOKS (*Chem. News*, 1902, 85, 196—197; from *Trans. Roy. Soc. Canada*, 1902, [ii], 7, 21).—The rate of diffusion of the emanation from a radium preparation was determined by an electrical method similar to that employed by Loschmidt (*Wiener Akad.*, 1871) in his experiments on the interdiffusion of gases. The emanating power of radium is increased 10,000 times by heating it to below a red heat, but is destroyed to a large extent by heating to a higher temperature. The values found for the coefficient of diffusion of the emanation into air lie between 0.08 and 0.15. As this coefficient varies inversely with the molecular weight, it is concluded that the emanation is not radium vapour, but a radioactive vapour or gas with a molecular weight between 40 and 100. It is probable that the emanation from thorium is of a similar character.

J. McC.

**Absorption of Radioactivity by Liquids.** By THOMAS TOMMASINA (*Compt. rend.*, 1902, 134, 900—902).—The author has obtained results similar to those obtained by Curie regarding the absorption of radioactive radiation by liquids and the consequent conductivity of dielectrics (this vol., ii, 298). The apparatus employed is described, and a table given of qualitative results on the absorption by a number of liquids comprising both organic compounds and aqueous solutions.

L. M. J.

**The Radioactive Elements considered as Examples of Elements undergoing Decomposition at the Ordinary Temperature, together with a Discussion of their Relationship to the other Elements.** By GEOFFREY MARTIN (*Chem. News*, 1902, 85, 205—206).—The author argues that as an element is heated it casts off electrons, and when this occurs the element is radioactive. According to his views, there exists for every element a temperature range at which this takes place, and he consequently regards radioactivity as a general property of matter. In the case of the ordinary radioactive substances, the ordinary temperature falls within the particular temperature range. The paper is purely speculative.

J. McC.



**Electrical Resistance of Steel and Pure Iron.** By CARL BENEDICKS (*Zeit. physikal. Chem.*, 1902, 40, 545—560).—Equivalent quantities of carbon, chromium, and other elements dissolved in steel cause an equal increase of hardness and determinations of the resistance of a number of samples of steel containing silicon, sulphur, phosphorus, and manganese indicated that the resistance is also equally affected by equivalent quantities of these elements, and may be calculated by the expression  $S = 7.6 + 26.8\Sigma C$ , where  $S$  is the resistance in microhms per c.c., and  $\Sigma C$  is the percentage of foreign substances calculated as equivalent quantities of carbon. The dissolved carbon alone is of influence, the precipitated carbon having no effect, but the experiments indicate that pure steel always contains about 0.27 per cent. of dissolved carbon, a result in accord with many metallurgical analyses. The resistance of perfectly pure iron is hence 7.6 microhms per c.c.; this value is less than any directly determined, but absolutely pure iron has never been investigated (see Abstr., 1901, ii, 374).

L. M. J.

**Improvement of Apparatus employed for the Measurement of the Dielectric Constant.** By PAUL DRUDE (*Zeit. physikal. Chem.*, 1902, 40, 635—637).—An improvement on the apparatus previously employed by the author (Abstr., 1897, ii, 438).

L. M. J.

**Some Phenomena of Voltaic Polarisation.** By MARCELLIN BERTHELOT (*Compt. rend.*, 1902, 134, 865—873).—In the simple voltaic cells investigated by the author (this vol., ii, 375, 376), it is shown that the addition of hydrogen or a reducing agent to the liquid at the negative electrode develops an *E.M.F.* of opposite sign and hence causes polarisation. Thus, in a cell containing solutions of sodium chloride at different concentrations, the *E.M.F.* fell from 0.12 volt to 0.026 volt when placed in an atmosphere of hydrogen, and again rose to the normal value when the hydrogen was replaced by nitrogen. Similar results were obtained with cells of lactic acid and sodium hydrogen carbonate. In an element of a Grove's battery, the electrodes are gaseous hydrogen and oxygen, and the *E.M.F.* is about 1.05 volts, although the decomposition of water necessitates between 1.5 and 1.6 volts. This the author considers to be due to the formation of platinum hydrides, the heat of formation of which, although variable for different states of the platinum, would be equivalent to about 0.6 volt. Experiments are also described on the polarisation effects of the addition of hydrogen peroxide and of pyrogallol to the different electrode liquids.

L. M. J.

**Electro-chemical Studies with Acetylene. I. Cathodic Depolarisation.** By JEAN BILLITZER (*Monatsh.*, 1902, 23, 199—216).—In alkaline or acid solution, acetylene acts as a depolariser towards a platinised cathode. When a current is passed between platinised electrodes in a voltameter containing aqueous acid or alkali through which acetylene is bubbled and the potential of the cathode measured against a free hydrogen electrode in the same acid or alkaline solution, it is found that ethylene, and afterwards ethane,

are given off before the potential of the cathode has fallen to that of the hydrogen electrode. With a higher *E.M.F.*, hydrogen is added to the products.

With platinum electrodes, the presence of acetylene, nitrogen, or carbon dioxide results in a rise in the *E.M.F.* required for the liberation of hydrogen. Electrolysis of acetylene in normal sulphuric acid solution with a mercury cathode leads to the formation of traces of alcohol.

G. Y.

**Electromotive Force of Metals in Solutions of Cyanide.** By S. B. CHRISTY (*Amer. Chem. J.*, 1902, 27, 354—420. Compare this vol., ii, 193).—The *E.M.F.* of potassium cyanide against silver decreases from +0.34 volt for *M* solutions to -0.5 volt for *M*/1,000,000 solutions. Similarly, for zinc, the values decrease from +0.945 to +0.330 volt; for lead from +2 to +0.04 volt; for mercury from +0.15 to -0.635 volt; in the case of iron, the values increase from -0.03 to -0.16 volt (*M* = gram-molecule per litre).

The solubility of gold in solutions of potassium cyanide of different strengths was determined; for all practical purposes, the cyanide ceases to act at a dilution below 0.001 per cent.

E. G.

**Researches on Electromotive Force.** By MARCELLIN BERTHELOT (*Compt. rend.*, 1902, 15, 793—807).—The author first considers at some length the various causes of difference between the actual thermal value of a chemical reaction, the apparent value under the conditions of the voltaic cell, and the voltaic thermal value. Determinations were then made of the *E.M.F.* produced by simple liquid mixtures in which there is no action of the liquid on the electrode. The following cases were investigated: (1) Action of an acid on a base. (2) Action of an acid on its sodium or ammonium salt. (3) Action of an alkaline base on a salt of the same base. (4) Action of acids on salts of other acids. (5) Action between two solutions of the same salt at different concentrations. In the first case, electromotive forces of about 0.5 volt were obtained, the values being lower than those calculated from the heats of neutralisation. In all the other sets of experiments, values varying from 0.1 to 0.4 volt were obtained, but in no case could exterior electrolysis be produced by the use of a number of cells.

L. M. J.

**Temperature Variations of the Specific Molecular Conductivity and of the Fluidity of Sodium Chloride Solutions.** By THOMAS R. LYLE and RICHARD HOSKING (*Phil. Mag.*, 1902, [vi], 3, 487—498. Compare Hosking, *Abstr.*, 1900, ii, 336).—The ratio of the specific molecular conductivity to the fluidity for a given concentration decreases proportionally to rise of temperature, and the temperature coefficient involved is the same for all concentrations. It is noted that for the stronger solutions at least the degree of dissociation decreases markedly with rise of temperature.

J. C. P.

**Method for Establishing the Electrolytic Action of a Pile.** By MARCELLIN BERTHELOT (*Compt. rend.*, 1902, 134, 873—876).—The author describes the method by which electrolytic action is detected,

and the apparatus employed for the purpose. The cells used were a Daniel of *E.M.F.* 1.06 volts, a zinc-cadmium cell of *E.M.F.* 0.35 volt, and a zinc-platinum cell of *E.M.F.* 0.80 volt. The *E.M.F.* required for the decomposition of water was found to be between 1.50 and 1.60 volts, and if pyrogallol or formaldehyde be added, between 0.70 and 0.80 volt.

L. M. J.

**Disintegration and Pulverisation of Cathodes due to the Formation of Alloys with Alkali Metals.** By FRITZ HABER and M. SACK (*Zeit. Elektrochem.*, 1902, 8, 245—255).—The disintegration and pulverisation of cathodes in alkaline solutions were observed by Bredig and Haber (*Abstr.*, 1898, ii, 78) and ascribed to the formation of alloys with alkali metals. The subject is now more fully investigated by observing the polarisation at lead and tin cathodes, and by measuring the potential difference between alkali metal alloys and a solution of lithium chloride (1.56 per cent.) in methyl alcohol, cooled by a mixture of solid carbon dioxide and ether. All the *P.D.*'s given are referred to an anode of mercury in contact with mercurous oxide and a normal solution of sodium hydroxide.

With a lead cathode in a solution of sodium hydroxide, pulverisation of the cathode began at 2.4 to 2.5 volts, a *P.D.* slightly lower than that between sodium and the lithium chloride solution, 2.7 volts. (The latter is not very different from the *P.D.* between sodium and a solution of sodium hydroxide at the ordinary temperature). At a lower *P.D.* (1.7 volts), hydrogen begins to be evolved, and the surface of the cathode is more or less disintegrated.

Alloys of sodium and lead containing 4.5 per cent. of sodium are brittle, act very slowly on water, and exhibit the same *P.D.* as lead (0.6 volt); those with 8 per cent. of sodium and more give a sudden pulverisation with water. The *P.D.* increases from 1.8 volts at 8 per cent., to about 2 volts with 30 per cent. of sodium. The pulverisation of the weaker alloys is only observed for a moment when a fresh surface comes into contact with water, whereas the more concentrated sodium alloys are pulverised completely and rapidly.

Tin behaves in the same way as lead; hydrogen is first evolved at 1.3 to 1.4 volts, and the metallic surface is etched; pulverisation begins at 2.3—2.4 volts. Alloys containing 8.6 per cent. of sodium show indications of pulverisation. Those with less than 6 per cent. do not. The *P.D.* between alloy and cooled lithium chloride solution shows a sudden increase from about 0.3 volt to about 1.4 volts at this point.

Zinc is neither disintegrated nor pulverised. The authors also failed to prepare alloys of sodium with it.

Platinum, heated to redness with sodium and then placed in alcohol, lost several decigrams of grey powdered platinum.

The *P.D.* between frozen sodium amalgams and the lithium chloride solution is about 0.7 volt less than the value found for sodium for all amalgams containing more sodium than corresponds with the formula  $\text{Hg}_5\text{Na}$ . Those containing less sodium have the same *P.D.* as mercury. The authors conclude that the dilute amalgams consist of a solution of  $\text{Hg}_5\text{Na}$  in mercury. The measurements throw no light on the composition of those containing more sodium.

T. E.

**Reducing Action of Lead and Mercury Cathodes in Solutions containing Sulphuric Acid.** By JULIUS TAFEL and KARL SCHMITZ (*Zeit. Elektrochem.*, 1902, 8, 281—288).—The experiments described previously (Abstr., 1900, ii, 588) are completed by careful comparative experiments on the relative efficiency of mercury and lead cathodes in the reduction of caffeine, which show that the mercury cathode is the better, the current efficiency being about 84 per cent., whilst with lead it is about 52 per cent. The addition of small quantities of tin to the mercury reduces its efficiency very rapidly.

In an alcoholic solution of sulphuric acid, at a mercury cathode, camphor is reduced to borneol, whereas at a lead cathode practically no reduction occurs.

Acetone is very slowly reduced at a lead cathode, the main product being pinacone. Under the same circumstances, the reduction at a mercury cathode takes place much more rapidly and also goes further, the acetone being converted quantitatively into isopropyl alcohol.

T. E.

**Behaviour of Platinum and Platinum-Iridium Anodes in the Electrolysis of Hydrochloric Acid.** By FR. BRAN (*Zeit. Elektrochem.*, 1902, 8, 197—201).—Haber and Grinberg have shown that platinum anodes are attacked more readily in concentrated than in dilute hydrochloric acid. The author now finds that in an acid of given strength the attack diminishes as the current density increases. This is explained by the diminution of the concentration of the acid in contact with the anode which is produced by the current, the diminution being greater with high current density. Platinum-iridium is less attacked than platinum.

T. E.

**Formation of Insoluble Precipitates by Means of Electrolysis with Soluble Anodes.** By MAX LE BLANC and EMIL BINDSCHEDLER (*Zeit. Elektrochem.*, 1902, 8, 255—264).—The formation of lead chromate by the electrolysis of a solution of sodium chlorate and chromate with a lead anode is investigated. With solutions containing from  $1\frac{1}{2}$  to 12 per cent. of salt, 70 to 90 per cent. of which is chlorate, the lead chromate is formed near the anode, separating from it by its own weight, whereas in solutions containing a large proportion of chromate an adherent layer of chromate and peroxide of lead forms on the anode. The yield of lead chromate is theoretical in the first case, practically zero in the latter. Sodium nitrate, acetate, or butyrate give practically the same result as chlorate. With the mixed electrolyte, the current is mainly transported by  $\text{ClO}_3$  ions, the chromate ions are therefore soon removed almost completely from the electrolyte in contact with the anode, and the precipitation of lead chromate takes place at some small distance from it. With a more concentrated chromate solution, this is not the case.

T. E.

**Theory of the Direct Method of Determining Ionic Velocities.**—By RICHARD ABEGG and W. GAUS (*Zeit. physikal. Chem.*, 1902, 40, 737—745).—The paper deals with some points raised by Steele's work (*Trans.*, 1901, 79, 414, and this vol., ii, 241).—The influence of the initial concentrations of the neighbouring electrolytes has been



studied, and it is recommended that in Steele's method the concentration in the indicator jelly should be at least equivalent to that in the middle electrolyte. The differences between the results obtained by Hittorf's method and those obtained by Steele's direct method are attributed to the influence of cataphoresis on the moving boundaries. When a correction for this influence is applied, Steele's method gives the same value for the transport number of chlorine as Hittorf's method.

The authors recommend a different method of illuminating the moving boundaries.

J. C. P.

**Determination of the Freezing Point Depression Constant for Electrolytes.** By THOMAS C. HEBB (*Trans. Nov. Scot. Inst. Sci.*, 1902, 10, 409—421).—The expression  $\delta = k(1 - a) + la$  is employed to obtain the depression constant,  $a$  being the ionisation coefficient and  $k$  and  $l$  being constants. If  $\delta$  is therefore plotted against  $a$ , a straight line should be obtained, and the author, after mapping these curves resulting from the work of different observers, has calculated the values of  $k$  and  $l$  from the portions of the curves which approximate most closely to straight lines. From these, the depression constants for undissociated molecules and free ions are obtained for potassium, sodium, hydrogen, barium, and ammonium chlorides; potassium and hydrogen nitrates; potassium hydroxide; potassium, sodium, hydrogen, and magnesium sulphates, and orthophosphoric acid. The constants for the ions do not vary greatly, and in all cases are not far removed from the theoretical value. The constants for the undissociated molecules, however, differ greatly, varying from 0.8—2.8, a result the author considers due to the fact that this constant cannot be determined as accurately as the former. The mean values obtained are respectively 1.851 and 1.932.

L. M. J.

**Liquid Mixtures of Minimum Boiling Point.** By CLIFFORD D. HOLLEY (*J. Amer. Chem. Soc.*, 1902, 24, 448—457).—By the boiling point process, the following minima have been found: 12.7 parts of amyl alcohol (b. p. 129°) and 87.3 parts of amyl bromide (b. p. 117.9°) give a liquid with boiling point 116.15°; 63.6 parts of isobutyl alcohol (105°) and 36.4 parts of amyl bromide (118.1°) give a liquid with boiling point 103.4°, the minimum point, however, is not very sharply marked; 70.7 parts of propyl alcohol (95.5°) and 29.3 parts of amyl bromide (118.2°) give a liquid with boiling point 94° (propyl alcohol may contain up to 65 per cent. of amyl bromide without having its boiling point raised); a mixture of 52 parts of amyl alcohol (128.9°) and 48 parts of amyl iodide (146.5°) boils at 127.3°; with mixtures of isobutyl alcohol or propyl alcohol with amyl iodide, no definite minimum could be found; 97.4 parts of amyl alcohol and 2.6 parts of amyl acetate give a mixture which boils at 129.1° (lower by 0.2° than the boiling point of the original alcohol). The following mixtures show no minimum boiling point: amyl alcohol with ethyl butyrate or bromoform; amyl acetate with ethylene bromide, amyl bromide, amyl iodide, bromoform or ethyl butyrate; and amyl bromide with ethyl butyrate or toluene.

J. McC.

**An Extension of the Idea of the Critical Constants.** By ALEXIUS BATSCINSKI (*Zeit. physikal. Chem.*, 1902, 40, 629—634).—The terms orthomeric and allomeric are suggested for compounds in which the molecular state is respectively (1) the same, and (2) different, in the liquid and saturated vapour. In a polymerised compound, the critical constants cannot be calculated by the law of corresponding states, and the values obtained by such a calculation, in the case of an orthomeric compound, are termed the meta-critical values, which vary with the temperature for which the calculation is made. The values of these meta-critical constants may, however, be used to determine the state of aggregation. Thus, for the critical constants  $p_1 v_1 M / T_1 = 16170$ , for the meta-critical constants  $PVxM/T = 16170$ , where  $x$  is the aggregation coefficient. The values thus obtained for acetic acid at 100°, 200°, and 300° agree satisfactorily with those obtained by Ramsay and Shields.

L. M. J.

**Measurements of Critical Constants. III.** By PHILLIPE A. GUYE and ED. MALLET (*Arch. Sci. phys. nat.*, 1902, [iv], 13, 462—489).—The concluding paper of a series (this vol., ii, 242, 302), in which the results are discussed. The conclusions arrived at have appeared previously (this vol., ii, 195, 243).

L. M. J.

**Determination of Inversion Temperature of Kelvin Effect in Hydrogen.** By KARL OLSZEWSKI (*Phil. Mag.*, 1902, [vi], 3, 535—540).—Pure hydrogen under high pressure is cooled by passing through a worm tube immersed in a suitable bath, and then allowed to escape into a box packed with chamois leather, expanding at the same time to atmospheric pressure. The box contains a resistance thermometer, which indicates whether the process of expansion is accompanied by a heating or a cooling effect. It has been found that above  $-80.5^\circ$  the expansion is accompanied by a heating, below  $-80.5^\circ$  by a cooling effect; that temperature, therefore, is the temperature of inversion of the Kelvin effect for hydrogen.

J. C. P.

**Volume Relations and Optical Characters of Isomorphous Mixtures.** By GEORG WULFF (*Zeit. Kryst. Min.*, 1902, 36, 1—14).—Retgers has shown that the sp. gr. (or sp. volume) of isomorphous mixtures is proportional to the chemical composition. It is now demonstrated, from determinations of the angles of optical extinction, that the refractive indices of mixed crystals of the series  $R'_2M''(SO_4)_2 \cdot 6H_2O$  are proportional to their volumes.

L. J. S.

**Significance of Changes of Atomic Volume II. Probable Source of Heat of Chemical Combination and a New Atomic Hypothesis.** By THEODORE W. RICHARDS (*Zeit. physikal. Chem.*, 1902, 40, 597—610).—The decrease of molecular volume in the formation of a number of metallic chlorides is compared with the heat of formation, and it is seen that there is an approximate parallelism between them; this is clearly evident when the values are recorded on the same diagram. A similar connection obtains in the case of metallic bromides and in the haloids of potassium. The author hence considers

it probable that the work necessary for the contraction resulting in the formation of a solid or liquid compound from two other elements or compounds is approximately proportional to the heat developed. It is stated that the work actually necessary for the compression of the equivalent quantities of sodium and chlorine into sodium chloride is actually of the same order of magnitude as the heat developed, but the values are not given. The author suggests an explanation, the fundamental basis of which is the supposition that the atoms themselves are elastic and compressible.

L. M. J.

**Osmotic Pressure of some Solutions Calculated from the E.M.F. of Concentration Elements.** By T. GODLEWSKI (*Bull. Acad. Sci. Cracow*, 1902, 146—163).—The *E.M.F.* of the elements,  $\text{Hg} \mid \text{HgCl} \mid \text{ZnCl}_2 \mid \text{Zn}$  (amalgam);  $\text{Hg} \mid \text{Hg}_2\text{SO}_4 \mid \text{CdSO}_4 \mid \text{Cd}$  (amalgam); and  $\text{Hg} \mid \text{HgCl} \mid \text{CdCl}_2 \mid \text{Cd}$  (amalgam), with varying concentration of zinc chloride, cadmium sulphate, and cadmium chloride respectively, was determined. The variation of the *E.M.F.* with the logarithm of the ratio ( $f$ ) of the concentration is given diagrammatically; at low concentrations, the *E.M.F.* increases slowly with  $\log h$ , but afterwards more quickly. The variation of the value of  $f/h$  with  $h$ , where  $f = (hRT/w)/m$ ,  $w$  being the specific volume of the solvent and  $m$  the molecular weight of the dissolved substance, has been traced. The value of  $f/h$  has a minimum value when the solution contains 0.73 gram-mol. of zinc chloride, 0.15 gram-mol. of cadmium sulphate, or 0.4 gram-mol. of cadmium chloride; this is not contradictory to the theory of electrolytic dissociation, but it shows that the gas laws can only be applied to solutions considerably more dilute than those corresponding with the minimum points. From the results obtained, the osmotic pressure and the degree of dissociation have been calculated with the aid of the theoretical considerations of Duhem and of Natanson, account being taken of the compressibility of water. The results are not in very good agreement with those obtained from the depression of the freezing point, the raising of the boiling point, or the conductivity.

J. McC.

**Retrograde Diffusion of Electrolytes.** By J. THOVERT (*Compt. rend.*, 1902, 134, 826—827).—If a solution containing an acid and another electrolyte be placed in communication with an equally concentrated solution of this electrolyte, not only does the acid diffuse, but also the electrolyte, so that during the first stages of the experiment its concentration, originally uniform, may vary considerably in different places. Thus, in one of the recorded experiments, hydrogen chloride was allowed to diffuse into a solution of sodium chloride of concentration 0.39. After 47 hours, the concentration of the sodium chloride was found to be, upper part, 0.373; middle, 0.380; lower, 0.405. These results are in accord with the electrolytic theory of diffusion.

L. M. J.

**So-called Liquid Crystals. II.** By GUSTAV TAMMANN (*Ann. Physik.*, 1902, [iv], 8, 103—108. Compare Abstr., 1901, ii, 231).—The author brings forward further evidence in support of his contention

that the so-called liquid crystals are merely emulsions. Separation of the liquids causing the emulsion can be effected, and it appears that *p*-azoxyphenetole, as usually prepared, is not chemically homogeneous. If *p*-azoxyanisole is sealed up in a tube hung vertically in an oil-bath and the temperature is slowly raised from its melting point, the turbidity of the uppermost layers disappears at  $119.7^{\circ}$ , and the clearing gradually extends to the lower layers, being complete at  $135^{\circ}$ . If the tube is allowed to cool, the same changes are observed in the reverse order; the lowest layers become turbid first, and the turbidity extends upwards, the uppermost layers becoming turbid at  $119^{\circ}$ . If the contents of the tube are stirred while the temperature is rising, turbidity disappears throughout the tube at  $134.5^{\circ}$ . This dependence of the temperature of clearing on the depth below the surface is characteristic of emulsions. J. C. P.

**Decomposition of Hydrated Mixed Crystals.** By REINHARD HOLLMANN (*Zeit. physikal. Chem.*, 1902, 40, 561—576).—An investigation into the phenomena of decomposition and formation of hydrated mixed crystals in solution. Three types of curve are obtainable, in which the decomposition temperature for any mixture (1) lies between those of the components, (2) reaches a maximum value, (3) has a minimum value. It is shown in the first type of mixture that at any determined temperature the mixed crystals of a higher hydrate are, in comparison with those of a lower hydrate, always richer in that component the addition of which raises the decomposition temperature. Mixtures of the heptahydrates of zinc and manganese sulphates were examined, the series being an example of the first of the above types. L. M. J.

**Double Salts of Zinc and Magnesium Sulphates.** By REINHARD HOLLMANN (*Zeit. physikal. Chem.*, 1902, 40, 577—580).—It has been previously shown by the author that in the case of mixed crystals of the heptahydrates of zinc and magnesium sulphates, two compounds exist in which the ratios of magnesium to zinc are respectively 2:1 and 1:1 (*Abstr.*, 1901, ii, 436). This is verified by the curve for the decomposition temperature, which is made up of three distinct curves with points of intersection where the ratios of magnesium to zinc are as just mentioned. Of these three curves, the first, from  $\text{MgSO}_4$  to  $2\text{MgSO}_4 \cdot \text{ZnSO}_4$ , is of the first type described in the preceding abstract, the other two curves are of the second type, the maximum decomposition temperatures agreeing with the points of minimum vapour pressure (*loc. cit.*). L. M. J.

**Composition of Hydrates of Gases.** By ROBERT DE FORCRAND (*Compt. rend.*, 1902, 134, 835—838).—The experimental determination of the composition of the hydrate of a gas is a matter of considerable difficulty, and for many such hydrates very diverse results have been obtained by different observers. The relation  $Q/T = 30$  may be applied in such cases to determine the number of mols. of water in the hydrate. In this expression,  $Q$  is the heat of formation from *solid* water, whilst  $Q_1$ , the heat of formation from liquid water, may be experimentally determined or deduced from the pressure curve by Clapeyron's formula.



The difference  $Q - Q_1$  is hence the heat of solidification of the water of the hydrate, and the number of mols. of water is therefore known.

L. M. J.

**Reciprocal Nature of Solubility Influences.** By VICTOR ROTHMUND and N. T. M. WILSMORE (*Zeit. physikal. Chem.*, 1902, 40, 611—628).—It is deduced theoretically that if the solubility of a compound  $A$  is lowered by the addition of  $B$ , then also the solubility of  $B$  is lowered by the addition of  $A$ . The quantitative connection is investigated, and the relation obtained is  $l_1 \log (L_1/l_1) = l_2 \log (L_2/l_2)$ , where  $L_1$  and  $L_2$  are the solubilities of the pure compounds, and  $l_1$ ,  $l_2$  the solubilities in a saturated solution of both. In the case of a non-electrolyte and dissociable compound, the first expression becomes  $il_1 \log (L_1/l_1)$ . As the partition coefficient gives the ratio of the solubilities in the two solvents, the ratio  $L_1/l_1 = K/k$ , where  $K$  and  $k$  are the partition coefficients with an indifferent solvent. The validity of the expression was verified by experiments on the solubility of salts in aqueous phenol and acetic acid, and on the effect of salts on the partition of these two compounds between water and chloroform.

L. M. J.

**Mechanism of the Catalytic Action of Iodine on the Bromination of Benzene.** By LUDWIK BRUNER (*Bull. Acad. Sci. Cracow*, 1902, 181—200. Compare Abstr., 1901, ii, 441).—The results of an investigation of the action of bromine on benzene in presence of iodine give a constant for  $K = 1/t \cdot \log x/(A - x)A$ , where  $t$  is the time,  $A$  the initial concentration of the bromine, and  $x$  the quantity which has reacted. This would indicate that the reaction is bimolecular. The reaction has been followed in solutions so dilute that there was only 1 gram-mol. of bromine to 25 gram-mols. of benzene, and a constant value has throughout been obtained for  $K$ . The extent of bromination depends on the concentration of the iodine, and it appears that reaction either ceases or becomes excessively slow when the residual bromine and the iodine are present in equivalent proportions.

Using Ostwald's method of determining the order of the reaction (quantity of substance transformed is inversely proportional to the velocity factors), it is found that the bromination of benzene in presence of iodine is a quadrimolecular reaction and takes place according to the equation:  $C_6H_6 + 4Br = C_6H_5Br + HBr_3 = C_6H_5Br + HBr \rightleftharpoons Br_2$ . Since the amount of bromine united with the hydrogen bromide is double that which has entered into reaction with the benzene, the reaction must appear of a lower order when this is calculated by van't Hoff's method. The bromination is carried out by free atoms of bromine and not by this substance in the molecular condition. The cause of the greater velocity in presence of iodine is that iodine bromide dissociates ( $I\text{Br} \rightleftharpoons I + Br$ ) more easily than bromine ( $Br_2 \rightleftharpoons 2Br$ ). The author discusses the rôle of dissociation in chemical reactions in general.

J. McC.

**Antiseptic Function of the Hydrogen Ions of Dilute Acids.** By MANFRED BIAL (*Zeit. physikal. Chem.*, 1902, 40, 513—534).—From the antiseptic effect of various salts and acids on certain spores, Paul

and Krönig concluded that this antiseptic action was not proportional to the concentration of the hydrogen ions, although such proportionality existed for certain weak acids (Abstr., 1897, ii, 155). The author has determined the effect of dilute acids in inhibiting yeast fermentation and compared the action of different acids on the same culture. The acids employed were hydrochloric, sulphuric, phosphoric, acetic, oxalic, formic, propionic, and butyric acids. The acids may be roughly divided into three groups, which are also equal dissociation groups, and the author considers that the antiseptic action is proportional to concentration of the hydrogen ions. The addition of a normal salt with similar cation caused a great decrease of the effect; by further addition, a minimum is reached after which the antiseptic action increases owing to the effect of the salt itself, this being completely analogous to the action of normal salts on inversion velocity.

L. M. J.

**Distinction between Polymorphism and Chemical Isomerism.**  
By GIUSEPPE BRUNI (*Atti R. Accad. Lincei*, 1902, [v], 11, i, 386—389).—The author discusses Wegscheider's paper (Abstr., this vol., ii, 126) on this question. The distinction between isomerism and polymorphism is that although each of two isomerides has a stable melting point in the sense of the phase theory, this is only the case with one of two polymorphs, the melting point of the other corresponding with a condition of unstable equilibrium which is destroyed by the presence of the smallest trace of the other form. Wegscheider's criterion for the existence of isomerism (that the form which is more stable in the neighbourhood of the melting point will have the lower melting point) is perfectly correct, but the conception of greater or less stability involved in it is more vague than, and quite different from, that of the stability or instability of a solid phase in equilibrium with a liquid phase. The true criterion for polymorphism or isomerism is this: If two compounds are isomerides, the addition of one of them to the other causes a change exactly similar to that brought about by the addition of any other compound, that is, the melting point is lowered and we have the well-known system of two descending curves meeting in a cryohydrate point at which the two forms of crystals co-exist. When one of the isomerides undergoes rapid transformation into the other form, it will be difficult or impossible to trace quantitatively the curve of fusion, but it will be possible to realise and to observe points of fusion either intermediate to those of the two isomerides or lower than either of them. With polymorphs, however, a quite different behaviour is observed. The melting point of the stable form is scarcely altered by the addition of the unstable modification, whilst the melting point of the latter is changed to that of the other form when the last is added in any proportion whatever. If, however, every trace of crystalline matter be destroyed by heating and the mixture be slowly cooled, the solidification point of the labile form may be realised. With polymorphs, these two solidification points are the only two obtainable; intermediate or inferior points, as well as a cryohydric point at which both kinds of crystals can exist, are here impossible.

T. H. P.

**Calculation of Atomic Weights.** By FRANK W. CLARKE (*Amer. Chem. J.*, 1902, 27, 321—328).—Attention is called to the desirability of distributing the errors of observation in the calculation of atomic weights instead of concentrating them on a single factor. Examples are given in which, by combining a number of ratios and assigning to each measurement weight inversely proportional to the square of its probable error, the influence of experimental error is divided up and distributed and even the influence of systematic error is diminished.

E. G.

**Atomic Weight Numbers.** By ALOIS BILECKI (*Chem. Zeit.*, 1902, 26, 399).—Attention is drawn to the fact that if the atomic weight of oxygen is taken as unity, a series of numerical relations between atomic weights of other elements become apparent.

K. J. P. O.

**The Nature of Radicles.** By FERDINAND HENRICH (*Ber.*, 1902, 35, 1773).—A *résumé* of the history of the theory of radicles not suitable for abstraction (compare *Abstr.*, 1899, i, 469, 794; 1900, i, 429; *Vorländer*, *Abstr.*, 1899, i, 312, 309; ii, 250).

G. T. M.

**Chemical Method for obtaining Vacua.** By FRANCIS G. BENEDICT and CHARLOTTE R. MANNING (*Amer. Chem. J.*, 1902, 27, 340—345).—The upper compartment of a Hempel desiccator is provided with fresh, dry sulphuric acid. After the material to be dried has been introduced, 10 c.c. of dry ether are poured on the floor of the desiccator and the cover is replaced. The pressure is now reduced by means of the water-pump to 60—40 mm. The stop-cock is closed and, owing to the absorption of the ether vapour by the sulphuric acid, in 8—10 minutes a vacuum of 4—1 mm. is obtained.

E. G.

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## Inorganic Chemistry.

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**Potential of Ozone.** By LEOPOLD GRÄFENBERG (*Zeit. Elektrochem.*, 1902, 8, 297—301).—The *E.M.F.* of the hydrogen ozone gas cell is found to be 1.65 volts for 10 per cent. ozone, or 1.66 volts for pure ozone. This value is very near the discharge potential of hydroxyl ions and it is pointed out that it is probable that ozone is formed by the reversible reaction,  $6\text{OH}' \rightleftharpoons \text{O}_3 + 3\text{H}_2\text{O}$ .

T. E.

**Generator for Hydrogen Sulphide.** By J. N. SWAN (*J. Amer. Chem. Soc.*, 1902, 24, 476—477).—The apparatus consists of two two-necked Woulff bottles. One of these having a side tube at the bottom contains iron sulphide and acid is introduced by means of a dropping funnel. The gas then passes into the other bottle, which serves the double purpose of washing it and collecting it over water. The dis-

placed water is forced up into a tube fitted with a large bulb. By opening the stop-cock fitted to an exit tube the gas becomes available for use.

L. DE K.

**Theory of the Lead Chamber Process.** By FR. RIEDEL (*Zeit. angew. Chem.*, 1902, 15, 462—465).—An attempt has recently been made by Meyer (*Zeit. angew. Chem.*, 1901, 14, 1245) to apply the law of mass action to the formation of sulphuric acid in the lead chamber. Lunge (*Zeit. angew. Chem.*, 1902, 15, 147) has criticised this adversely and the author now adversely criticises Lunge's statement. The author believes that the law of mass action can be applied to the process, but only approximate results can be obtained, because the temperature and the concentrations vary at different points in the chamber. He further points out that chemical dynamics is not sufficiently developed to indicate the temperature optimum for any reaction, although Lunge has attempted to decide this for the particular reaction in question.

J. McC.

**Electrolytic Preparation of Persulphates without a Diaphragm.** By ERICH MÜLLER and O. FRIEDBERGER (*Zeit. Elektrochem.*, 1902, 8, 230—236).—A saturated solution of potassium hydrogen sulphate is electrolysed at a low temperature (7°) without a diaphragm. Platinum electrodes are used and the current density at the anode is about 0.5 ampere per sq. cm. The yield of potassium persulphate is 35 per cent. of the theoretical quantity.

By using a saturated solution of ammonium sulphate containing a small quantity of potassium dichromate (1 gram to 500 c.c. of solution), 80 per cent. of the theoretical yield of ammonium persulphate is obtained, provided that the ammonia formed is neutralised from time to time with sulphuric acid.

T. E.

**Synthesis of Ammonia by Electricity.** By ALEXANDER DE HEMPTINNE (*Bull. Acad. roy. Belg.*, 1902, 28—35).—When a mixture of nitrogen and hydrogen in the proportion 1 : 3 is subjected to electric discharges, the amount of ammonia formed is influenced by the temperature and pressure of the gas mixture and by the mode of application of the discharge. The rate of combination increases as the sparking distance is diminished and a similar effect is produced by lowering of temperature or diminution of pressure. Pressure exerts less influence when sparks derived from a Tesla coil are used or when the discharge is silent than is the case when a Ruhmkorff coil is employed. Control experiments showed that combination is effected, not by the glowing platinum of the terminals, but by the electric discharge itself.

T. A. H.

**Method of Preparation of Azoimide.** By SIMEON M. TANATAR (*Ber.*, 1902, 35, 1810—1811. Compare Abstr., 1899, ii, 479).—On oxidising a mixture of hydrazine and hydroxylamine in mol. proportion in acid solution by means of bromine water, permanganic acid, lead dioxide, or red lead, a small quantity of azoimide is always formed. When hydrogen peroxide is used, a yield of 24.3 per cent. is obtained,



and with chromic acid, a yield of 29·27 per cent. In both cases, the oxidising agent is slowly added to a hot solution of the two bases in dilute sulphuric acid; the azoimide is then distilled off.

K. J. P. O.

**Oxidation of Nitrite by Permanganate.** By JOHN WADDELL (*Chem. News*, 1902, 85, 158).—By treating sodium nitrite with a small quantity of a mixture containing the desired proportion of permanganate and sulphuric acid, then warming slightly with a few drops of sulphuric acid, adding the remainder of the mixture and completing the reaction by the addition of a few drops or so of permanganate, a slightly cloudy neutral solution is produced and the reaction nearly corresponds with that represented by the equation:  $5\text{NaNO}_2 + 3\text{H}_2\text{SO}_4 + 2\text{KMnO}_4 = 5\text{NaNO}_3 + \text{K}_2\text{SO}_4 + 2\text{MnSO}_4 + 3\text{H}_2\text{O}$ , in which an excess of sulphuric acid is not necessary.

D. A. L.

**Acids of Phosphorus. II. Velocity of Hydration of Pyrophosphoric Acid.** By CLEMENTE MONTEMARTINI and U. EGIDI (*Gazzetta*, 1902, 32, i, 381—388. Compare Abstr., 1901, ii, 551).—The authors have measured the velocity of transformation of pyrophosphoric into orthophosphoric acid at a temperature of 19° and in solutions of different concentrations. The reaction, which proceeds according to the equation  $\text{H}_4\text{P}_2\text{O}_7 + \text{H}_2\text{O} = 2\text{H}_3\text{PO}_4$ , was controlled acidimetrically. The results show that metaphosphoric acid undergoes hydration much more slowly than pyrophosphoric acid, which cannot be kept unchanged for very long even when in dilute solution. For low concentrations of pyrophosphoric acid the hydration is but little influenced by the catalytic action of the hydrogen ions, which, however, exert a considerable effect in the more concentrated solutions. It is pointed out that, unlike the acids themselves, salts of metaphosphoric and pyrophosphoric acids are very stable in solution, and undergo hydration with difficulty.

T. H. P.

**Fusion of Carbon.** By A. LUDWIG (*Zeit. Elektrochem.*, 1902, 8, 273—281).—The experiments were made in a vessel filled with hydrogen under a pressure of 1500 to 3000 atmospheres. Carbon rods, with their ends in contact with each other, were heated by an electric current; after a few seconds, the current sank to nothing, soon increasing again to its former strength. This went on for some minutes. The author assumes that the carbon points fuse to the transparent modification of carbon, which, like other transparent substances, is a non-conductor of electricity. Owing to the interruption of the current, the temperature falls and the transparent carbon changes into graphite, whereupon the process is repeated.

In order to obtain the transparent fused carbon in the solid form, it appears necessary to cool it so quickly that the transformation into graphite cannot take place. Attempts to obtain rapid cooling by means of hydrogen gas and by dropping the fused carbon into water were unsuccessful owing to the difficulty of obtaining a sufficiently rapid flow of gas in the first case and to the occurrence of Leidenfrost's phenomenon in the second.

By allowing water, under a pressure of about 2200 atmospheres, to rush into the vessel containing a fused mixture of carbon and iron, a piece of iron was obtained about 30 mm. in diameter and so brittle that it could be powdered between the fingers. When dissolved in acid, it left a greyish, crystalline powder of the hardness and specific gravity of diamond.

In conclusion, it is pointed out that the formation of natural diamonds has probably taken place by the sudden cooling of carbonaceous materials at a high temperature and under great pressure.

T. E.

**Direct Combination of Chlorine and Carbon.** By RICHARD LORENZ (*Zeit. Elektrochem.*, 1902, 8, 203—204).—The author observed the direct combination of chlorine and carbon in 1893 (*Zeit. angew. Chem.*, 7, 313).

T. E.

**Lithium Silicide.** By HENRI MOISSAN (*Compt. rend.*, 1902, 134, 1083—1087).—When amorphous or crystalline silicon is heated with sodium or potassium in a vacuum at the boiling point of the metal, very little silicide is formed. *Lithium silicide* can be prepared, when silicon (prepared by Vigouroux's method, Abstr.; 1895, ii, 222, 263, 447) is heated with lithium in a vacuum for two or three hours, finally at a temperature of dull redness. The excess of lithium can be removed either by treating the product with liquid ammonia, which reacts with lithium, forming lithium ammonium, a substance soluble in liquid ammonia, or by distilling off the lithium at 400—500° under reduced pressure from the silicide. Lithium silicide,  $\text{Li}_6\text{Si}_2$ , forms small, lustrous crystals of a deep indigo-blue, has a sp. gr. 1.12, and is decomposed in a vacuum above 600° into lithium and amorphous silicon. Hydrogen, above 600°, yields, with the silicide, lithium hydride and silicon. When warmed in gaseous fluorine, reaction takes place with incandescence, producing lithium and silicon fluorides; with chlorine, bromine, and iodine, the reaction is similar, but a higher temperature is required before it begins. Heated in air, it burns and melts; in oxygen, much light and heat are developed. It reacts with molten sulphur with great vigour, a lithium polysulphide and a sulphide of silicon being formed; the last-mentioned substance is decomposed by cold water with evolution of hydrogen sulphide. Selenium, tellurium, and phosphorus all attack the silicide with production of incandescence. Arsenic and antimony form crystalline alloys only slowly attacked by cold water. Lithium silicide reduces the oxides of iron, chromium, and manganese, alloys being produced. When the silicide is placed on sulphuric acid, it becomes incandescent, hydrogen sulphide is evolved, and sulphur formed. With nitric acid, it reacts explosively, producing nitrogen peroxide and silica. With hydrochloric acid, the silicide becomes incandescent and then coated with hydrated silica; at low temperatures, or when dilute acid is used, a gas spontaneously inflammable in air is evolved; it burns with a very white flame and deposits amorphous silica; an ethereal solution of hydrogen chloride has no action on the silicide. The reaction with water is very violent; a spontaneously inflammable gas is evolved, and a solution of lithium

hydroxide containing silica in suspension is obtained. If the reaction is moderated by covering the silicide with glycerol, pure hydrogen is evolved. With aqueous solutions of alkalis, only hydrogen is evolved. It appears that water always decomposes the silicide with formation of hydrogen and a hydrogen silicide,  $\text{Si}_2\text{H}_6$ ; the latter is decomposed by alkalis.

K. J. P. O.

**Mixed Crystals of Silver Chlorate and Sodium Chlorate, and their Solutions.** By H. W. FOOTE (*Amer. Chem. J.*, 1902, 27, 345—354).—It has been shown (Abstr., 1901, ii, 19) that when the sulphates of copper and zinc crystallise from aqueous solution depositing mixed crystals of two different forms, the composition of the crystals at the 'mixing limit' changes with change of temperature. It is now found that a similar statement is true in the case of silver and sodium chlorates. Retgers has shown (Abstr., 1890, 1208) that mixed crystals of these salts are readily obtained in two forms, cubes of sodium chlorate containing 11 mols. per cent. of silver chlorate and tetragonal crystals of silver chlorate containing 41.75 mols. per cent. of sodium chlorate. The 'mixing limits' of these two forms have been determined at 12°, 25°, 35°, and 50°; the results are tabulated.

The relation existing between the salts in solution and the mixed crystals has been studied, with the following results. The proportion of sodium chlorate in the dissolved chlorates in a solution is greater than in the mixed crystals from the solution. As the temperature is raised, the percentage of sodium chlorate in the dissolved chlorates becomes more nearly equal to the percentage of this chlorate in the mixed crystals. By recrystallising the mixed chlorates, pure silver chlorate can be obtained, but pure sodium chlorate cannot be obtained in this way since the recrystallised product contains more silver chlorate than the mother liquor.

E. G.

**Conditions of Formation and Stability of the Hydrides and Nitrides of the Alkaline Earths.** By HENRI GAUTIER (*Compt. rend.*, 1902, 134, 1108—1111).—When an alloy of cadmium and strontium is heated in a closed space with hydrogen (compare this vol., ii, 208) absorption of the gas begins at 340°; at 470—570°, gas is again evolved, to be followed by a second absorption at a higher temperature. At 675°, dissociation of the strontium hydride begins. Very similar results were obtained when an alloy of cadmium and barium was heated in hydrogen. Quantitative experiments show that both strontium and barium hydrides absorb hydrogen readily at the ordinary temperature, and become largely increased in volume. When heated at 70—80° in a vacuum, the evolution of this absorbed hydrogen begins. This absorption of hydrogen does not appear to be due to the formation of a second hydride richer in hydrogen. Calcium hydride has not the power of absorbing hydrogen.

The nitrides of these metals can be obtained by heating their alloys with cadmium, but the combination does not begin below 600°; the nitrides are quite stable at 1000°. The hydrides of barium and strontium are able to absorb nitrogen at the ordinary temperature. When heated with nitrogen, replacement of the hydrogen only begins

towards  $600^{\circ}$ . In the case of calcium, the nitride is not formed below  $700^{\circ}$ ; that is, at a temperature above that ( $675^{\circ}$ ) at which the hydride is dissociated.

K. J. P. O.

**Formation of Calcium Carbide.** By VICTOR ROTHMUND (*Chem. Centr.*, 1902, i, 1045; from *Nachr. k. Ges.-Wiss. Göttingen*, 1901, 224—233).—Experiments on the formation of calcium carbide were made in an electric furnace containing a carbon tube surrounded by layers of carbon and magnesia. The mixture of carbon and lime in the proportion of 12:7 was placed in small carbon tubes which were heated in the larger tube. The temperature was estimated by measuring the intensity of the light emitted on Lummer and Pringsheim's scale. The action does not take place when 700 watts or less are used; it begins at  $1620^{\circ}$ , and corresponds with a partial pressure of the carbon monoxide of one-fifth of an atmosphere. Experiments showed that when calcium carbide is heated with carbon monoxide at temperatures below  $1620^{\circ}$ , a portion of the carbide is decomposed. The temperature of formation of the carbide may be reduced by decreasing the partial pressure of the carbon monoxide.

E. W. W.

**Behaviour of Magnesium Chloride in River Waters.** By HUGO ERDMANN (*Zeit. angew. Chem.*, 1902, 15, 449—455).—From analyses of water from the River Wipper at various stations and at different periods, it is proved that: (a) the water becomes more concentrated in magnesium chloride in the neighbourhood of the potash salt deposits without the influx of water from manufactories; (b) as the amount of magnesium chloride increases, there is often a decrease in the total quantity of dissolved salts; (c) as the river rises, the hardness increases if the current is sufficiently strong to stir up the heavier aqueous layers lying in the bed of the stream; and (d) when there is no fresh inflow of solutions, the quantity of magnesium chloride decreases at the lower parts of the river. The author discusses the causes which give rise to effect (d), and shows that they are purely chemical and can be reproduced in the laboratory.

J. McC.

**Electrical Preparation of Colloidal Mercury and other Metals.** By JEAN BILLITZER (*Ber.*, 1902, 35, 1929—1935).—Colloidal mercury is obtained by electrolysis of very dilute solutions of mercurous nitrate between electrodes of platinum, zinc, iron, lead, or nickel; it imparts a yellow or brown colour to the solution. The best result is obtained with a 0.004*N* solution of the nitrate, and a current of 0.2—0.3 ampere at 220 volts; the larger the electrodes, other conditions being the same, the more easily is the colloidal metal formed. Pure colloidal mercury is also obtained by carrying out Bredig's method of "pulverisation" with amalgams or precipitates of mercury on wires which are not themselves pulverisable (compare *Abstr.*, 1899, ii, 78). In the same manner, other metals can be "pulverised" which hitherto have not been obtained in the colloidal form, for example, copper, nickel, iron, zinc, and lead; in all cases, the action is facilitated by using a roughened surface and a loose, superficial aggregation.

W. A. D.



**Application of the Phase Rule to the Fusing Points of Copper, Silver, and Gold.** By THEODORE W. RICHARDS (*Amer. J. Sci.*, 1902, [iv], 13, 377—378).—Holborn and Day (*Abstr.*, 1901, ii, 85) found that gold has a very constant melting point, that of silver is inconstant, and copper apparently has two constant melting points. As gold does not dissolve oxygen, its melting point is not liable to fluctuations, but silver absorbs oxygen, and therefore there are two substances present; unless the concentration of the oxygen be determined, the conditions are too few (solid, liquid, and vapour) to determine a fixed point. The melting point of silver varies, therefore, with the amount of dissolved oxygen. In the case of copper, oxidation takes place and the lower constant melting point is that found when the copper is saturated with cuprous oxide; the higher melting point is that found when oxygen is excluded. J. McC.

**Preparation of the Cerite Metals from "Cerium Oxalicum Medicinale."** By C. R. BÖHM (*Zeit. angew. Chem.*, 1902, 15, 372—380).—After the extraction of thorium from monazite sand, the residue is worked up with oxalic acid into *Cerium oxalicum medicinale*, which contains salts of the rare metals as well as of cerium.

A pure cerium salt is obtained by igniting the crude oxalate and dissolving the residue in double the quantity of concentrated nitric acid; ammonium nitrate is added to the solution and ceric ammonium nitrate crystallises out. If too large an excess of nitric acid is present, the double salt does not crystallise well. The whole of the cerium cannot be removed in this way. The mother liquor from the double salt is treated with oxalic acid, the precipitate dried and ignited, and the greater part of the residue dissolved in concentrated nitric acid, the remainder being converted into a suspension in water. The suspension is added to the solution, and the mixture boiled until, when a small portion is filtered off and the filtrate boiled with hydrogen peroxide, a pure white precipitate is obtained on making it alkaline with ammonia. The liquid is then filtered, the filtrate precipitated with oxalic acid, and the oxalate ignited. The oxide so produced is dissolved in nitric acid, ammonium nitrate is added, and the solution evaporated to the crystallising point. Lanthanum ammonium nitrate separates out, and after fifteen crystallisations it can be obtained almost entirely free from praseodymium. Most of the lanthanum is thus extracted, and to remove the remainder the oxalate is again precipitated and the dried salt added to boiling concentrated sulphuric acid. The sulphates, being insoluble in sulphuric acid, settle down; the sulphuric acid is poured off, and the salts are dried by heating in a platinum basin. The anhydrous sulphates are powdered and added to a small quantity of ice water; on warming the solution to about 20°, a precipitate very rich in lanthanum sulphate separates, whilst the didymium salts remain dissolved. By repeating this process, a didymium sulphate can be obtained practically free from lanthanum but containing a small quantity of yttrium metals. The lanthanum may also be conveniently removed by fractionation with ammonia. By crystallisation of the potassium sulphate double salts from potassium sulphate solution, an almost pure didymium salt

can be obtained, and the relative proportions of praseodymium and neodymium determined by spectroscopic analysis. In the residue from the didymium salt, samarium was detected by the spectrum as well as metals of the yttrium series (terbium, yttrium, erbium, and gadolinium).

The proportion of oxides contained in *Cerium oxalicum medicinale* is estimated at: yttrium oxides (yttrium, ytterbium, erbium, terbium, and gadolinium), 0.2 per cent.; cerite oxides, 99.71 per cent. ( $\text{Ce}_2\text{O}_3$ , 51.35;  $\text{La}_2\text{O}_3$ , 24.16;  $\text{Nd}_2\text{O}_3$ , 16.20;  $\text{Pr}_2\text{O}_3$ , 8.00 per cent., and samarium, trace). J. McC.

**Rare Earths of the Yttrium Group. I.** By LOUIS M. DENNIS and BENTON DALES (*J. Amer. Chem. Soc.*, 1902, 24, 401—435).—The authors have studied various methods of separating the earths of the yttrium group in order to ascertain along what lines different treatments cause the earths to separate. An historical account of this group is also given. The progress of the separation was followed by determining the atomic weight by Gibbs's method (Abstr., 1894, ii, 47) or that of Krüss (Abstr., 1893, ii, 283); these methods, however, have been shown to be infected with an error. The material used was sipylite from Virginia and from Texas, and the spectroscopic examination showed that this contained yttrium, ytterbium, erbium, thulium, holmium, samarium, dysprosium, and possibly didymium. The results obtained from experiments on the fusion of the yttrium group nitrates with alkali nitrates (compare Dennis and Magee, Abstr., 1895, ii, 15) were irregular and gave no indication of a sharp separation by this method. Comparison of the spectrum of the original mixture of chlorides with that of the substance precipitated from solution by hydrogen chloride showed no change of the relative intensities of the lines. Partial decomposition of the chromates does not lead to an appreciable separation. Fractional precipitation of a solution of the nitrates with potassium chromate separates the earths with considerable rapidity, and this method is particularly valuable for obtaining yttria free from the other earths. The first effect of precipitation with potassium oxalate is to weaken the holmium lines in the spectrum. Erbium has the most soluble oxalate and that increases in the mother liquors by fractional precipitation with potassium oxalate. The decomposition voltages of the rare earths are not sufficiently different to permit of a practical separation by fractional decomposition of a solution of the mixed electrolytes by the electric current. Precipitation with magnesia and treatment with potassium azoimide do not lead to effective separation, whilst although separation can be carried out by fractional precipitation with ammonia, it is extremely slow and tedious. A satisfactory separation can be made by fractional extraction of the precipitated hydroxides with ammonium carbonate solution. A quantity of ammonium carbonate solution is used sufficient to dissolve one-fourth of the precipitate, and when the solution is slowly precipitated with dilute acetic acid, a crystalline salt containing only ytterbium, erbium, and a trace of samarium is obtained. By this fractional treatment, terbium and yttrium concentrate at one end of the series, erbium and ytterbium at the other, and the middle fractions contain the holmium, thulium, and dysprosium. J. McC.

**Melting Point of Manganese.** By W. C. HERAEUS (*Zeit. Elektrochem.*, 1902, 8, 185—187).—Manganese (99 per cent.) was fused in an electrically heated porcelain tube in a current of hydrogen. The metal rested on a bed of pure alumina and the moment of fusion was observed through a telescope, the temperature being given by a thermo-element placed close to the manganese. The melting point found was  $1245^{\circ}$ . In an atmosphere of nitrogen, combination with the metal takes place rapidly at temperatures above  $1210^{\circ}$ . T. E.

**A Reaction of Iron and Steel.** By V. VON CORDIER (*Monatsh.*, 1902, 23, 217—235).—When commercial iron is dissolved in a dilute acid and, during or after the evolution of gas, the solution is made alkaline, a distinct odour of carbylamine may be observed. Pure iron and iron containing carbon only or nitrogen only do not give the reaction. After passing carbon monoxide and nitrogen over pure iron, the reaction is obtained. As a mixture of iron containing carbon and iron containing nitrogen does not give the reaction, and as it is not obtained with a preparation made by mixing iron containing carbon with manganese nitride, the carbon and nitrogen must be in combination in the iron which gives the carbylamine odour. An iron containing 32 per cent. of manganese did not absorb an abnormal amount of nitrogen. By passing the carbylamine obtained from iron into dilute hydrochloric acid and adding platinum chloride, a platinichloride is formed which, under the microscope, closely resembles in appearance ethylamine platinichloride. The formation of formic acid when the carbylamine is passed into dilute sulphuric acid is shown by conversion into carbon monoxide and its detection by the palladium chloride and spectroscopic tests. G. Y.

**Compounds of Iron and Silicon.** By PAUL LEBEAU (*Ann. Chim. Phys.*, 1902, [vii], 26, 5—31).—A detailed account of the properties of the iron silicides and of the constituents of ferrosilicons (compare Abstr., 1901, ii, 317, and this vol., ii, 135, 264). G. T. M.

**Salts of Chromic and Dichromic Acids.** By WILHELM AUTENRIETH (*Ber.*, 1902, 35, 2057—2064).—Silver chromate,  $\text{Ag}_2\text{CrO}_4$ , is formed when excess of a solution of silver nitrate is added to a solution of potassium dichromate. Silver dichromate,  $\text{Ag}_2\text{Cr}_2\text{O}_7$ , on the other hand, is obtained when a solution of potassium chromate or dichromate is mixed with a boiling dilute solution of silver nitrate containing excess of dilute nitric acid, or when excess of a solution of chromic acid is added to a boiling solution of silver nitrate, or when silver chromate is digested with warm dilute nitric acid. This salt forms lustrous red, rhombic leaflets; frequently, however, it is obtained darker in colour, and then very closely resembles iodine; it is decomposed by cold water into chromic acid and silver chromate, which, when thus formed, consists of dark green, or nearly black, rhombic crystals. By heating the red amorphous form of silver chromate in a stream of carbon dioxide, it is converted into the dark green variety.

Barium dichromate,  $\text{BaCr}_2\text{O}_7$ , can be prepared by heating together

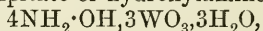
moist barium chromate and chromium trioxide; it crystallises in slender needles, and is decomposed by water into chromic acid and barium chromate. No evidence of the existence of barium trichromate was found, or of that of lead dichromate (compare Preis and Rayman, *Abstr.*, 1880, 444).

Chromium trioxide reacts vigorously with dry hydrogen chloride, forming only chromium oxychloride. Aqueous hydrochloric acid (35—40 per cent.) gives also chromium oxychloride, 35 per cent. of the chromic acid used distilling over. With more dilute hydrochloric acid (20 per cent.), chlorine is formed as well as the oxychloride.

K. J. P. O.

**Oxides of Tungsten.** By EUGENE T. ALLEN and V. H. GOTTSCHALK (*Amer. Chem. J.*, 1902, 27, 328—340).—When tungstic acid is heated with an acid solution of stannous chloride, it undergoes reduction with formation of an insoluble *hydroxide*,  $W_5O_{14} \cdot H_2O$ . The same compound is obtained by heating tungstic acid with fuming hydriodic acid at 200° in a sealed tube. It forms a dark blue powder with a purplish lustre; it is insoluble in water acidified with hydrochloric acid, but in pure water it seems to form a colloidal solution. It is readily oxidised by exposure to the air or by oxidising agents, and is instantly converted into the trioxide by the action of heat. When heated with a solution of an alkali hydroxide, hydrogen is evolved and a tungstate is produced, whilst by the action of ammonia, ammonium tungstate and a brown residue are formed, but no gas is evolved. This brown residue is a *hydroxide* of the composition  $W_3O_8 \cdot H_2O$ ; when washed and dried, it has a deep purple colour with a bronze lustre; in its chemical behaviour, it resembles the blue compound.

If hydroxylamine hydrochloride is added to a solution of sodium tungstate, a white precipitate of hydroxylamine tungstate,



is produced, which when dry is of a pale yellow colour.

E. G.

**Uranium Sulphates.** By WILLIAM OECHSNER DE CONINCK (*Bull. Acad. roy. Belg.*, 1902, 94—97, 161—163. Compare *Abstr.*, 1901, ii, 390, 556).—The author has determined the solubilities of uranic and uranous sulphates in various media, and finds that one part of each of the solvents named below dissolves the following quantities of these salts at the temperatures mentioned :

Uranic sulphate—

Alcohol, 85 per cent. ....	37.9 at 16.7°	38.6 at 15.8°
Hydrochloric acid (conc.) .....	3.4 „ 12.8	3.25 „ 13.6
Hydrobromic acid of sp. gr. 1.21... ..	5.9 „ 12.9	6.1 „ 11.2
Nitric acid (conc.) .....	10.8 „ 12.3	11.2 „ 10.8
Sulphuric acid of sp. gr. 1.138 .....	4.3 „ 12.7	4.1 „ 14
Nitric acid and water (equal volumes) .....	5.6 „ 15.4	5.47 „ 16.4
Sulphuric acid and water, 1 : 4.....	3.7 at 15.3	

The salt is slightly soluble in formic and acetic acids.



## Uranous sulphate—

Water .....	4.23 at 13°	4.3 at 11.3°	4.4 at 9.1°
Hydrochloric acid and water, 1 : 4 .....	—	5.74 „ 9.7	5.8 „ 9.2
Nitric acid and water, 1 : 4 .....	—	5.4 „ 11.2	5.53 „ 10.3
Selenic acid of sp. gr. 1.4 and water 1 : 4...	—	4.57 „ 11.4	4.66 „ 10.7
Alcohol (94 per cent.) and water, 1 : 4 ...	—	8 „ 10.4	8.2 „ 9.6

The aqueous solutions in the order mentioned deposited small quantities of a basic sulphate after 24, 30, and 38 hours respectively.

## Sulphuric acid

and water, 1 : 4 .....	6.36 at 11.7°	6.42 at 10.9°	6.45 at 10.1°	6.5 at 9°
Hydrobromic acid and water, 1 : 4	4 „ 15	4.23 „ 14.2°	—	—
Acetic acid and water, 1 : 4.5 .....	4.1 „ 15.5	4.3 „ 14.4°	—	—
Acetic acid and water, 1 : 2 .....	3.72 „ 16.5	3.85 „ 15.9°	—	—

When solutions of uranic (or uranous) sulphate are hydrolysed in a U-tube cooled by immersion in water, there is first deposited on the negative electrode the yellow, hydrated oxide,  $U_2O_3 \cdot 2H_2O$ , and finally a greenish precipitate consisting of the oxide and a small proportion of a basic sulphate. In the absence of the cooling medium, the black oxide,  $U_4O_6$ , is formed. When aqueous alcoholic solutions of uranic sulphate are exposed to light, a mixture of uranous sulphate with a small quantity of basic uranic sulphate is deposited. The filtrate, on exposure to violet or blue light, forms at first a hydrated uranoso-uranic oxide, and eventually the black oxide,  $U_4O_6$ . T. A. H.

**Electrolysis of Potassium Antimony Tartrate.** By FRANZ VON HEMMELMAYR (*Monatsh.*, 1902, 23, 263—268. Compare Büttger, *J. pr. Chem.*, 1856, 68, 372).—Electrolysis of a saturated solution of potassium antimony tartrate or of sodium antimony tartrate results in the deposition of antimony mixed with small quantities of antimony trioxide. Marchand's suboxide,  $Sb_3O_2$ , is not formed. G. Y.

## Mineralogical Chemistry.

**A New Association of Gold.** By HENRY F. COLLINS (*Zeit. Kryst. Min.*, 1902, 36, 92; from *Eng. & Mining J.*, 1900, 69, 464).—Crystals of bornite in wollastonite from the Santa Fe mine, Chiapas, Mexico, gave on analysis the results under I. The gold [ $? 0.00333$  per cent.] for the most part cannot be amalgamated, and is probably present as sulphide. The ore, where richest in gold, is intergrown with garnet, copper-pyrites, a little galena, enargite, &c.

Massive bornite from the upper workings of the mine sometimes contains nodules and grains of siegenite, which gave the results under II (As, Sb, Bi, Ti are absent).

	Cu.	Ag.	Au.	Fe.	Ni.	Co.	S.	Insol. (quartz).	Total.
I.	62.1	0.2	0.0333	—	—	—	—	—	—
II.	5.32	0.13	0.53	3.32	17.15	29.64	44.31	0.43	100.83.

L. J. S.

**Minerals Occurring in Australian Bat Guano.** By R. W. EMERSON MACIVOR (*Chem. News*, 1902, 85, 181—182, 217. Compare Abstr., 1887, 708—709).—Further confirmatory analyses of hannayite, newberyite, and struvite are given, as well as descriptions of the other constituents of bat guano alluded to in his previous communication. *Dittmarite*,  $\text{MgNH}_4\text{PO}_4 \cdot 2\text{Mg}_2\text{H}_2(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$ , occurs as small, transparent, rhombic crystals. Analysis gave:

MgO.	FeO.	MnO.	$(\text{NH}_4)_2\text{O}$ .	$\text{P}_2\text{O}_5$ .	Water.
25.67	0.38	0.08	3.94	46.51	23.42

*Schertalite* (for which the name muellerite, already in use, was first suggested) occurs in small, flat crystals of somewhat indistinct character, with difficulty freed from adhering and included guano. They lose water of crystallisation at  $120^\circ$ , but not at  $100^\circ$ , and on ignition yield magnesium metaphosphate. Analysis gave:

MgO.	FeO.	MnO.	$(\text{NH}_4)_2\text{O}$ .	$\text{P}_2\text{O}_5$ .	$\text{H}_2\text{O}$ .
12.17	0.20	0.05	16.15	43.88	27.55

corresponding with the formula  $\text{Mg}(\text{NH}_4)_2\text{H}_2(\text{PO}_4)_2 \cdot 4\text{H}_2\text{O}$ . The "drier" guano deposits in which these various constituents occur contains: water, 19.80; organic matter, 52.83; ash, 27.37 per cent. The organic matter contains 2.98 of nitrogen nearly all as nitrate; the ash contains:

$\text{Fe}_2\text{O}_3 \cdot \text{Al}_2\text{O}_3$ .	$\text{CaO}$ .	$\text{MgO}$ .	$\text{Na}_2\text{O}$ .	$\text{K}_2\text{O}$ .	$\text{P}_2\text{O}_5$ .	$\text{SO}_3$ .	$\text{SiO}_2$ (sol.).	$\text{CO}_2$ .	Insoluble.	Mn.
5.23	2.00	0.58	2.93	1.79	5.38	1.57	1.06	2.00	3.65	trace

Reference is made to a white, nodular constituent, apparently consisting mainly of tribasic magnesium phosphate, which will be more fully described later.

D. A. L.

**Formation of Oceanic Salt Deposits, particularly of the Stassfurt Beds. XXVI. Formation of Loeweite and the Lower Temperature Limit of the same at 43°.** By JACOBUS H. VAN'T HOFF and A. O'FARELLY (*Sitzungsber. K. Akad. Wiss. Berlin*, 1902, 370—375).—Dilatometric experiments show that astracanite,  $\text{MgSO}_4, \text{Na}_2\text{SO}_4, 4\text{H}_2\text{O}$ , is transformed into loeweite,  $\text{MgSO}_4, \text{Na}_2\text{SO}_4, 2\text{H}_2\text{O}$ , at 71°, and this result is confirmed by comparing the tensions at various temperatures of (1) a dry mixture of loeweite and astracanite, and (2) a mixture of astracanite with 2 mols. of water. When a solution of sodium and magnesium sulphates in molecular proportion is evaporated at a temperature above 71°, astracanite is first obtained, but this is transformed into loeweite on contact with the mother liquor and inoculation with a small quantity of partially dehydrated astracanite. The temperature of transition of astracanite into loeweite is lowered in presence of other soluble salts, such as sodium chloride, and reaches its lower limit at 43°. The paper contains also determinations of the tension of the water of crystallisation in astracanite at various temperatures between 25° and 71°, and an equation is obtained which expresses satisfactorily the relation between the vapour tensions of water and astracanite over this range. The process represented by the equation  $\text{MgSO}_4, \text{Na}_2\text{SO}_4, 2\text{H}_2\text{O} + 2\text{H}_2\text{O} = \text{MgSO}_4, \text{Na}_2\text{SO}_4, 4\text{H}_2\text{O}$  is accompanied by the evolution of 6600 cal. J. C. P.

**Minerals from the Pacific States.** By HENRY W. TURNER (*Amer. J. Sci.*, 1902, [iv], 13, 343—346).—Brief notes are given of the occurrence of the following less common minerals in the United States east of the Rocky Mountains: pyromorphite, monazite, apatite, vivianite, chloropal, diopside, idocrase, jarosite and nickel minerals (perhaps gersdorffite and genthite).

The apatite, as a constituent of gneiss in the Sierra Nevada, appears to be neither a fluoro- nor a chloro-apatite. The golden-brown micaceous mineral from Nevada, referred to jarosite, differs from this in containing sodium (nearly 6 per cent.) instead of potassium. Idocrase from limestone at its contact with granite in the Silver Peak quadrangle, gave on analysis by G. Steiger:

$\text{SiO}_2$ .	$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	$\text{FeO}$ .	$\text{CaO}$ .	$\text{MgO}$ .	$\text{Na}_2\text{O}, \text{K}_2\text{O}$ .	$\text{H}_2\text{O}$ .	$\text{TiO}_2$ .
36.80	17.53	3.27	1.56	35.00	1.23	0.13	1.66	0.66
Total								
$\text{CO}_2$ .	$\text{P}_2\text{O}_5$ .	$\text{SO}_3$ .	Cl.	F.	MnO.	BaO.	less O for F.	
0.65	0.07	nil	nil	0.88	0.48	nil	99.56.	

Partial analyses are given of the chloropal and diopside. L. J. S.

**Fusion Point of Minerals and the Petrographic and Synthetic Conclusions derived from the Results.** By A. BRUN (*Arch. Sci. phys. nat.*, 1902, [iv], 13, 352—374).—The melting point was determined in a specially constructed furnace, a chip of the mineral being supported inside on the top of a small platinum tube across which a thin wire was stretched; the temperature was registered by means of Seger cones. The fusion point of basic silicates is very definite;

acid silicates persist in a semi-solid condition for a considerable time. The melting points of various minerals belonging to the amphibole group, the felspar group, and the pyroxene group were determined as well as those of various other minerals.

The author applies his results to the solution of certain geological problems in connection with the temperature of the lava ejected from volcanoes, and the determination of the conditions of the crystallisation of rocks. The greater part of the mineral matter of a basic lava is produced at a temperature between  $1200^{\circ}$  and  $2000^{\circ}$ . In the formation of acid rocks, the first stage is the production of a colloidal hydroxide which can withstand the temperature of  $830^{\circ}$ ; on cooling to  $800^{\circ}$ , reaction takes place between this hydroxide and the acid silicates present. This theory satisfactorily accounts for the presence of liquid inclusions contained in the quartz of a granite, and the presence of micas containing fluorine.

J. McC.

[Pyroxene, Labradorite and Pseudomesolite from Minnesota.] By ALEXANDER N. WINCHELL (*Zeit. Kryst. Min.*, 1902, 36, 70—72; from *Amer. Geol.*, 1900, 26, 151—188, 197—245, 261—306, 348—388; and *Thèse Fac. des Sci. Paris*, 1900).—The following mineral analyses are given in a petrographical description of the gabbros, &c., of Minnesota. I, Pyroxene from olivine-diabase at Pigeon Point; the optic axial angle is small and variable in size ( $2E = 13^{\circ}16' - 62^{\circ}24'$ ), and on account of this abnormal character the name *pigeonite* is proposed. II, Labradorite ( $Ab_3An_4$ ) from anorthosite at Carlton Peak; crystallographic and optical determinations are given. III, *Pseudomesolite* in radially fibrous masses which are colourless or white; it is probably triclinic and resembles mesolite in chemical composition, but differs from this in optical characters:

	SiO <sub>2</sub> .	TiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	MnO.	CaO.
I.	45.05	4.39	0.16	5.50	14.90	1.58	10.72
II.	53.38	—	29.70	0.21	—	—	11.90
III.	45.25	—	25.69	1.40	—	—	9.75

	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Total.	Sp. gr.
I.	15.15	0.78	1.27	0.13	99.63	—
II.	trace	0.56	4.30	0.37	100.42	2.701
III.	trace	0.47	4.24	12.99	99.79	2.219

L. J. S.

[Analysis of Talc, Halloysite and Lenzinite.] By GEORGE P. MERRILL (*Zeit. Kryst. Min.*, 1902, 36, 73; from *Rep. U. S. National Museum* for 1899, 1901, 155—483).—A "Guide to the Study of the Collections of the Section of Applied Geology (the Non-metallic Minerals)" in the United States National Museum, gives descriptions of the useful minerals, with notes on their modes of origin, localities and applications. Numerous analyses are given, of which the following are new. I—VI, Steatite from various localities in the United States. VII, Halloysite from Edwards Co., Texas. VIII, Soap-stone (lenzinite) from Ventura Co., California.



	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	FeO.	MgO.	CaO.	MnO.	Na <sub>2</sub> O.	K <sub>2</sub> O.	H <sub>2</sub> O.	Total.
I.	42.43	6.08	13.07	25.71	3.27	trace	0.16	0.32	8.45	99.49
II.	51.20	5.22	8.45	26.79	1.17	0.32	—	—	6.90	100.05
III.	38.37	5.64	8.86	28.62	3.90	trace	—	—	14.49	99.88
IV.	52.70	5.57	7.63	26.88	1.77	—	—	—	5.48	100.03
V.	40.03	10.86	9.59	26.97	1.70	—	—	—	10.78	99.93
VI.	33.47	0.45	7.38	32.72	1.34	0.21	—	—	23.00	99.57
VII.	45.32	39.77	—	—	—	—	—	0.30	13.38	99.27
VIII.	67.55	12.97		0.85	0.77	—	3.63	1.43	13.67	100.87

L. J. S.

**Anorthite and Epidote.** By WILLIAM F. HILLEBRAND (*Bull. U.S. Geol. Survey*, 1900, No. 167, 69—70).—Specimens of metamorphic limestone from Phippsburg, Maine, with much cinnamon garnet and a little green pyroxene, contain here and there, embedded in the masses of garnet, brilliant plates of a dark gray to nearly black mineral, which is shown by the following analysis (I) to be epidote, although it does not present the usual appearance of this mineral; the determination as epidote was confirmed under the microscope. Associated with the epidote is anorthite (anal. II, by G. Steiger).

	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	FeO.	CaO.	MgO.	Ignition.	Total.
I.	38.54	28.39	6.89	0.50	24.12	trace	2.26	100.70
II.	45.62	35.29	—	—	17.31	—	—	98.22

L. J. S.

[Bytownite and Diopside from Maine.] By E. C. E. LORD (*Zeit. Kryst. Min.*, 1902, 36, 72; from *Amer. Geol.*, 1900, 26, 329—347).—The following mineral analyses are given in notes on the geology and petrology of Monhegan Island, Maine. (I) Bytownite (AbAn<sub>6</sub>) from olivine-norite. (II) Diopside from gabbro-pyroxenite.

	SiO <sub>2</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	FeO.	CaO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Total.	Sp. gr.
I.	48.06	—	32.54	—	—	17.51	—	—	1.77	—	99.88	2.72
II.	40.61	0.65	25.90	2.18	5.37	14.50	7.69	0.25	2.31	0.78	100.24	2.91

L. J. S.

[Allophane ? from Kansas.] By AUSTIN F. ROGERS (*Zeit. Kryst. Min.*, 1902, 36, 79—81; from *Kansas Univ. Quart.*, 1900, 9, 161—165).—A list is given of the minerals found in the zinc and lead district of Joplin in Missouri and Kansas. Allophane (?) occurs as a thin coating on zinc-blende at Galena in Kansas; it is amorphous, translucent, colourless to pale-brown or green, and with a resinous lustre; analysis gave:

SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	H <sub>2</sub> O.	Total.	Sp. gr.
24.76	[41.66]	33.58	100.00	1.94

L. J. S.

**Meteoric Irons.** By EMIL W. COHEN (*Ann. k.k. naturhist. Hofmus. Wien*, 1900, 15, 351—391).—In No. XI of his *Meteoric Iron Studies*, the author gives the results of the examination of 19 irons, with numerous analyses of the irons as a whole and of the various minerals (cohenite, schreibersite, tönite, amorphous carbon and cliftonite) isolated from them.

L. J. S.

## Physiological Chemistry.

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**Hereditary Transmission of Hæmolysins.** By WILLIAM BULLOCH (*Trans. Path. Soc.*, 1902, 53, 189—196).—Hæmolysins were produced in rabbits by injecting blood-corpuscles of the ox; the characters of the blood of the offspring were examined. The hæmolytic power is not transmitted by the male if the mother is normal. If the mother was rendered immune after conception, abortion occurred, but the foetal blood was highly hæmolytic. If the mother was immunised before conception, the serum of the offspring was more hæmolytic than that of the mother, owing to its containing a greater quantity of the complement. The immune substance also passes out in the milk, but in diminishing quantities in successive litters. Hæmolysins are demonstrable in the blood of the young four months after birth. The results coincide with those obtained by Ehrlich with ricin and tetanus. W. D. H.

**Hæmolysin of Bacillus Megatherium.** By CHARLES TODD (*Trans. Path. Soc.*, 1902, 53, 196—214).—In cultures of *B. megatherium* a specific lysin occurs which hæmolyses the corpuscles of guinea-pig, monkey, and man. In guinea-pigs, this is sufficient to cause hæmoglobinuria and death. It is destroyed by heating to 56° for half-an-hour. The formation of the lysin takes place best in alkaline broth at 37°. The normal serum of many animals exercises an anti-hæmolytic power towards this lysin, and this action is increased by heating at 63° for half-an-hour. Subcutaneous injection of the lysin gives rise to a powerful anti-hæmolysin. By partial neutralisation, the lysin yields a characteristic spectrum, as was shown by Ehrlich with tetanus lysin and diphtheric toxin. The lysin is also divisible into parts named prototoxin (a toxoid), deuterotoxin, tritotoxin, and a fourth substance of the nature of a toxone. W. D. H.

**Does Lipase Exist in the Serum?** By DOYON and MOREL (*Compt. rend.*, 1902, 134, 1002—1005).—Normal serum, if aseptic, contains no ferment which splits or saponifies olein. W. D. H.

**The Substitution of Chlorine by Bromine.** By T. HONDO (*Chem. Centr.*, 1902, i, 1118; from *Berlin Klin. Woch.*, 39, 205—209).—With an ordinary mixed diet, bromine salts are rapidly eliminated; still traces remain for months. If, however, insufficient sodium chloride is given, the elimination is much slower. There is no marked influence on metabolism if the lessening of sodium chloride is not continued too long. In the treatment of such maladies as epilepsy with bromides, the lessening of the common salt in the diet is therefore recommended. W. D. H.

**Feeding Experiments with Chondroitinsulphuric Acid.** By A. KETTNER (*Chem. Centr.*, 1902, i, 1020; from *Arch. exp. Path.*

*Pharm.*, 47, 178—199).—Amyloid substance is a combination of proteid and chondroitinsulphuric acid. Oddi found that feeding animals with this acid did not produce amyloid degeneration. In the present experiments on rabbits, an acid nutriment was first given, and then hydrochloric acid and sodium chondroitinsulphate. The animals suffered from acid poisoning but nothing further. Chondroitinsulphuric acid is not affected by gastric or pancreatic juices, so its destruction is a metabolic process. Long continued acid poisoning in rabbits causes no increase in the excretion of ammonia by these animals. The difference between the dog and the rabbit in this direction is believed to be absolute, not relative. W. D. H.

**Non-absorption of Antitoxin from the Stomach and Rectum.** By RICHARD TANNER HEWLETT (*Trans. Path. Soc.*, 1902, 53, 220—221).—The experiments were made on rabbits and guinea-pigs with the antitoxin of diphtheria and tetanus. No trace of either is absorbed by the mucous membrane of the stomach or of the rectum. W. D. H.

**Purine Substances in Articles of Diet.** By J. WALKER HALL (*Chem. Centr.*, 1902, i, 1169—1170; *Inaug. Diss. Owens Coll. Manchester*).—An extension of the work of Burian and Schur (*Abstr.*, 1897, ii, 333) on the amount of purine nitrogen in numerous articles of diet. A modification of their method of estimation is proposed, in which the relative volume of the silver precipitate is measured. W. D. H.

**Contact Irritability of Muscles.** By W. D. ZOETHOUT (*Amer. J. Physiol.*, 1902, 7, 320—324).—If the calcium salts in the muscle are decreased, the efficiency of potassium ions to increase its tone is increased. If the potassium ions in the muscle are increased, the efficiency of such salts as sodium oxalate and citrate to cause contact-irritability is increased. Contact irritability depends, as Loeb suggested, on the disturbance of the normal ratio of salts in the muscle. Perhaps it is the disturbed ratio between the potassium and the calcium salts which makes the contact reaction possible. W. D. H.

**Diastatic Ferment of the Suprarenal Body.** By ALFRED C. CROFTAN (*Pflüger's Archiv*, 1902, 90, 285—289).—Solutions of the precipitate produced by saturating extracts of suprarenal capsules with ammonium sulphate have a diastatic action, converting starch into maltose and, later, into dextrose. Both a maltase and a glucase are therefore present. Arguments are adduced in favour of the existence of such a disease as suprarenal glycosuria. W. D. H.

**Influence of Lecithin on the Development of the Skeleton and Nervous System.** By ALEXANDRE DESGREZ and ALY ZAKY (*Compt. rend.*, 1902, 134, 1166—1168).—The administration of lecithin in animals produces a retention of phosphoric acid, which is normally utilised for the development of bone and nerve tissue. The increase of lecithin in the nervous system is not directly due to the lecithin given, but to that synthetically formed in the animal. W. D. H.

**Variations in the Composition of Cows' Milk during Milking.** By EDWIN ACKERMANN (*Milch-Zeit.*, 1902, 31, 166—168).—The usual statement, that the percentage of fat in milk increases gradually as the milking proceeds, was not found to be correct, according to the experiments described in this paper. It was ascertained, however, that, by milking the teats singly or in pairs, the fat showed an increase up to a maximum at the end of the milking. On drawing the milk from the second pair of teats, the amount of fat at the commencement was slightly more than that given by the first pair, and rose at the end to a higher maximum. The increase is possibly due to mechanical or physiological stimulus. W. P. S.

**Nitrogenous Metabolism in a Case of Bright's Disease.** By J. A. BUTLER and A. S. FRENCH (*Trans. Path. Soc.*, 1902, 53, 236—274).—The patient was a child who suffered from acute parenchymatous nephritis. If the proteid of the urine is not reckoned, the proportion of nitrogen excreted as urea was normal, but if the proteid is included, it was less than in health. This holds good for both uræmic and non-uræmic periods. The uræmic period was marked by an output of nitrogen in excess of the intake, and a high and almost constant ratio of uric acid to urea. The amount of nitrogen in the faeces was greater than in healthy children on a milk diet. W. D. H.

**Chylous and Chyliform Ascites.** By ROBERT HUTCHISON (*Trans. Path. Soc.*, 1902, 53, 274—276).—Cases are described of both these varieties of ascites. In the true chylous ascites, the milky appearance is due to fat, presumably from ruptured lacteals. In the chyliform variety, the fluid appears like a solution of glycogen. Fat, lecithin, and mucoid are absent; the opalescence is ascribed to some form of nucleo-proteid. Such fluids have no special significance and are met with in various pathological conditions. W. D. H.

**Glycosuria of Muscular Origin.** By CADÉAC and MAIGNON (*Compt. rend.*, 1902, 134, 1000—1002).—Crushing injuries to muscles in guinea-pigs, dogs, and men causes the appearance in the urine of sugar and, to a greater extent, of glycuronic acid. These substances are of muscular origin, and are found in extracts of the injured muscles, but not in those of healthy muscles. W. D. H.

**Low Proteid Metabolism.** By VAUGHAN HARLEY and FRANCIS GOODBODY (*Trans. Path. Soc.*, 1902, 53, 228—235).—Full details are given of patients suffering from obesity and neurotic disturbances, who maintained approximate equilibrium on an extremely small amount of proteid nutriment. W. D. H.

**Chemical Constitution and Physiological Action.** By MARC LAFFONT (*Compt. rend.*, 1902, 34, 861—863).—Accordingly as arsenic is united to one or two methyl groups, its toxicity varies from one to five. In therapeutic purposes, the monomethyl compound is preferable if given by the mouth; the dimethyl compound acts more rapidly and is not decomposed in the blood; it should be given hypodermically.



In the case of the substituted derivatives of the benzenoid hydrocarbons, the group which most completely masks the toxic action of the original hydrocarbon or even that of its phenolic derivative (phenol guaiacol) is  $\text{SO}_3\text{H}$ ; thus in the compound  $\text{C}_6\text{H}_5\cdot\text{SO}_3\text{H}$  the benzene is rendered inoffensive and invigorating. W. D. H.

**The Power of the Sulphate to neutralise the Ill Effects of the Chloride of Sodium.** By ANNE MOORE (*Amer. J. Physiol.*, 1902, 7, 315—319).—The experiments were made on tadpoles and mosquito larvæ. Loeb found that the toxic effect of salts with a univalent cation and a univalent anion can be annihilated by bi- or ter-valent cations, but not by uni-, bi-, or ter-valent anions. The present results with sodium sulphate and chloride show that it is possible in one case at least to annihilate the poisonous effects of a salt of this character by a bivalent anion. Sodium oxalate, however, has not the same effect. The explanation is not yet evident. W. D. H.

## Chemistry of Vegetable Physiology and Agriculture.

**Production of Parasitic Races from Common Bacteria.** By L. LEPOUTRE (*Compt. rend.*, 1902, 134, 927—929).—It was shown by Laurent (*Ann. Inst. Pasteur*, 1899, 13), that *Bacillus coli communis* and *B. fluorescens putridus*, which are normally harmless, may be transformed into very active parasites of potatoes and carrots.

Carrots from plots manured with excessive amounts of nitrogen, potassium, superphosphate, calcium carbonate, and sodium chloride respectively were inoculated with *Bacillus fluorescens liquefaciens*, *B. mycoides*, and *B. mesentericus vulgare* and kept at 30°. *B. fluorescens* proved to be the most active, especially on the roots manured with nitrogen and with calcium carbonate. Cultivations of all three bacilli were, however, obtained which possessed the power of living as parasites on the carrots of all the plots. The roots of the superphosphate plot were the most resistant. Similar results were obtained when turnips were inoculated with the parasitic microbes.

Feeding roots resisted the action of the bacilli, which, however, rapidly attacked the roots after treatment for an hour with 0.1 per cent. soda.

Two actions are shown to take place, one due to a diastase, *pectinase*, which dissolves pectic substances, and the other to a substance which coagulates protoplasm. Pectase is destroyed at 62°, whilst the coagulating substance resists a temperature of 100°. N. H. J. M.

**Butyric Fermentation.** Occurrence and Biological Relations of the mobile Butyric Bacillus. By ARTHUR SCHATTENFROH (*Arch. Hygiene*, 1902, 42, 251—264).—This bacillus is strictly anaërobic and only grows well in solutions containing soluble fermentable carbo-

hydrates and organic nitrogenous substances. It scarcely attacks proteid substances, although it requires them for growth, but ferments mono- and di-saccharides, starch, and glycerol, whilst it has no action on mannitol and on lactates. The products of the fermentation of the carbohydrates are butyric acid, lactic acid, carbon dioxide, and hydrogen, but the proportions in which they are produced vary considerably. In only one case was butyl alcohol produced. The ratio of lactic to butyric acid is also very variable, and whereas some strains of the organism produce *i*-lactic acid, others produce the *d*-acid. The bacillus does not produce any proteolytic enzyme in the media in which it is cultivated, but regularly produces an amylase, whilst sucrase was found on one occasion.

A. H.

**Rancidity of Butter.** By ORLA JENSEN (*Centr. Bakt. Par.*, 1902, 8, ii, 11—16, 42—46, 74—80, 107—114, 140—144, 171—174, 211—216, 248—252, 278—281, 309—312, 342—346, 367—369, 406—409).—When butter is exposed to sunlight in presence of oxygen, the latter is absorbed, the iodine number of the butter fat diminishes, and the butter acquires an unpleasant odour and taste, but in the absence of micro-organisms there is scarcely any production of free acid, and the butter does not become rancid. True rancidity is caused by various micro-organisms, all of which are aërobic, so that the rancidity spreads from the outside inwards. The chief organisms concerned are *Oidium lactis*, *Cladosporium butyri*, *Bacillus fluorescens liquefaciens*, and sometimes *B. prodigiosus*, the ordinary lactic acid-producing organisms taking no part in the phenomenon. These organisms of rancidity decompose the butter fat, probably by means of a steapsin, although this is not quite certain, with the production of both volatile and non-volatile acids. In addition to this, *Cladosporium* has the power of producing butyric esters, the alcoholic radicle being most probably supplied by decomposition products of the glycerol set free from the decomposed fats. The two moulds, however, exert a destructive action on the volatile fatty acids and tend to diminish their amount. The addition of milk sugar to the butter diminishes the production of esters, whilst the addition of salt chiefly diminishes the amount of volatile acids. The action of the organisms which produce rancidity is considerably diminished by the presence of bacilli of the lactic acid group, the lactic acid produced being probably the active substance.

A. H.

**Fermentation of Cellulose.** By V. OMELIANSKI (*Centr. Bakt. Par.*, 1902, 8, ii, 193—201, 225—231, 257—263, 289—294, 321—326, 353—361, 385—391. Compare Abstr., 1896, ii, 202; 1898, i, 291; 1900, ii, 493).—Two species of bacilli have been found which bring about a fermentation of cellulose, and these occur very widely in soil, manure, sewage deposits, river mud, &c. They cannot be isolated in the ordinary way as they do not grow on solid media, and the method of accumulation was therefore employed. Neither of these species is identical with the *Bacillus amylobacter*, which, according to van Tieghem, is the chief organism which attacks cellulose. The first species brings about a hydrogen fermentation of cellulose, 3.22

grams of the latter being converted into 0.014 gram of hydrogen, 0.9722 gram of carbon dioxide, and 2.24 grams of fatty acids, consisting of a mixture of 1 part of butyric acid with 1.7 parts of acetic acid.

The second species brings about the methane fermentation of cellulose, the products derived from 2.03 grams of the latter being 0.14 gram of methane, 0.87 gram of carbon dioxide, and 1.02 grams of fatty acids, consisting of a mixture of 1 part of butyric acid with 9 parts of acetic acid. Both the species grow best at 35—40°. A. H.

**Formation of Oxalic Acid by Bacteria.** By FRIEDRICH BANNING (*Centr. Bakt. Par.*, 1902, ii, 8, 395—398, 425—431, 453—456, 520—525, 556—567).—Eight new species of oxalic acid forming bacteria have been found, so that in all 15 species are known which have this function. The effect of all these has been tried on a large number of organic substances added to solid media, and the culture then examined qualitatively for oxalic acid. Of the carbohydrates examined, it was found that oxalic acid was formed from dextrose by all the 15 species, from arabinose by 11, from levulose, galactose, maltose, sucrose, milk-sugar, raffinose, rhamnose, *isolichenin*, and dextrin by only a few of the species, and from starch, inulin, glycogen, and gum arabic by none. Among the alcohols, oxalic acid was formed from ethylene glycol, and from glycerol by 8 species, from erythrol by 7 species, from ethyl alcohol by 4 species, from mannitol by 3 species, and from methyl, propyl, butyl, and amyl alcohols and dulcitol by none. Of the acids, oxalic acid was formed from pyrotartaric acid by 9 species, from glycollic acid by 8 species, from malonic acid by 5 species, from acetic and *isobutyric* acids by 3 species, and from formic acid, propionic acid, butyric acid, valeric acid, succinic acid, malic acid, tartaric acid, citric acid, glycine, sarcosine, and leucine by none. None of the species was able to produce oxalic acid from urea, uric acid, creatine, creatinine, benzoic acid, hippuric acid, salicylic acid, or tyrosine.

A. H.

**Products of the Fermentation of Sucrose by a Mucus-forming Bacillus, and the Composition of a Carbohydrate isolated from the Mucus.** By FRANZ SCHARDINGER (*Centr. Bakt. Par.*, 1902, ii, 8, 144—147, 175—181).—The bacillus, which was isolated from an impure drinking water and appears to be closely allied to *Bacillus lactis pituitosi*, Loëfller, has the power of rendering media, both with and without sugar, slimy or ropy. When cultivated in sucrose solution in presence of ammonium chloride and inorganic salts together with calcium carbonate to neutralise the acid produced, the sucrose is decomposed, hydrogen being evolved, and alcohol, acetic acid, succinic acid, and *L*-lactic acid produced, the last-named being the chief product. The mucus or slime may be isolated by evaporating in a vacuum, precipitating with alcohol, dissolving in very dilute alcohol, filtering, and then repeatedly precipitating with alcohol and redissolving in water, about 6.5 grams being finally obtained from 50 litres of culture medium. It forms a white mass which is free from nitrogen and has the composition  $C_6H_{10}O_5$ . It is optically inactive and forms an oily

solution in water, which is not ropy but becomes gelatinous at low temperatures. Distillation with hydrochloric acid produces furfuraldehyde, whilst oxidation converts the substance into oxalic and mucic acids. Acid hydrolysis yields a dextrorotatory sugar the exact nature of which has not yet been ascertained. The substance isolated is probably a galactan and does not itself appear to be the cause of the ropiness of the culture solutions. Further investigations on this point are in progress. A. H.

**Denitrification.** By HUGO WEISSENBERG (*Centr. Bakt. Par.* 1902, ii, 8, 166—170. Compare *Arch. Hygiene*, 30, 274).—The decomposition of nitrates observed by Wolf (*Hygienesche Rundschau*, 9, 518, 1169), in solutions containing sugar is largely due to the liberation of nitrous acid by the acid produced from the sugar, followed by the decomposition of the unstable acid, whereas true denitrification proceeds in alkaline solution. When a culture of a denitrifying organism containing nitrite is exposed to air, the same amount of oxygen is absorbed as in a culture free from nitrite, but in the former case the growth of the organism is much more plentiful, owing to the fact that the oxygen of the nitrite is also used. A. H.

**Constituents of the Flowers of the Coffee Tree.** By L. GRAF (*Zeit. öffentl. Chem.*, 1892, 8, 148—150).—The flowers were obtained from trees twenty years old growing in Réunion; they were yellowish-brown and had an intensely bitter taste. They were found to contain caffeine (0.92 per cent.), phytosterol, a reducing sugar, and probably caffetannic acid. N. H. J. M.

**Occurrence of Oleodistearin in the Fat of the Seeds of Theobroma Cacao.** By R. FRITZWEILER (*Chem. Centr.*, 1902, i, 1113; from *Arb. Kais. Ges.-A.*, 18, 371—377. Compare Heise, *Chem. Rev. Fett.-Harz-Ind.*, 6, 91; *Arb. Kais. Ges.-A.*, 13, 302).—Six per cent. of oleodistearin has been isolated from the fat of *Theobroma cacao* after removing the cocoa fat by Heise's method. E. W. W.

**Aroma of Tobacco.** By SIGMUND FRÄNKEL and ALFRED WOGRINZ (*Monatsh.*, 1902, 23, 236—238).—Attention is drawn to nicotianine, an alkaloid obtained from tobacco (Landerer, *Repert. Pharm.*, 53, 205), which has been overlooked by later authors.

On distilling tobacco with steam, a milky distillate, possessing the odour of tobacco, is obtained, from which no crystals separate. It gives precipitates with mercuric chloride, silver nitrate, phosphotungstic acid, lead acetate, and picric acid. The *picrate* forms small, yellow, silky needles, melts at 214°, and is soluble with difficulty in cold and more easily in boiling alcohol or water. G. Y.

**Influence of Iron on the Combustibility of Tobacco.** By G. AMPOLA and S. JOVINO (*Gazzetta*, 1902, 32, i, 367—380).—The authors give a number of analyses of different kinds of tobacco the combustibilities of which were also determined. From the results they conclude that the factors influencing the combustibility of tobacco are



its state of division and the amount of metals exhibiting catalytic actions, especially of iron contained in it. T. H. P.

**Effect of Lime on the Insoluble Phosphates in the Soil.** By WALTER F. SUTHERST (*Chem. News*, 1902, 85, 157).—When ferrous, ferric, and aluminium phosphates containing respectively 25·92, 23·26, and 28·68 per cent. of phosphoric acid were digested in quantities of a gram each with 1 gram of citric acid dissolved in 100 c.c. of water, for 24 hours, 10·64, 10·62, and 11·16 per cent. of the total phosphoric acid in each case passed into solution. By digesting 1 gram of each of these phosphates, however, with 2 grams of lime in 100 c.c. of water for periods of 24, 48, and 72 hours, neutralising the lime with citric acid, and then subjecting the products to the treatment with citric acid, the quantity of phosphate dissolved was in all cases greatly augmented, and after the 72 hours' digestion with lime amounted to 85·88, 96·55, and 72·00 per cent. of the total phosphoric acid in the ferrous, ferric, and aluminium phosphates respectively. D. A. L.

**Origin of Arsenic in Certain Beers.** By ARTHUR PETERMANN (*Bul. Inst. Chim. Bact. de l'Etat Gembloux*, 1902, No. 72, 18—21).—The examination of five samples of Belgian superphosphate showed that two of them contained traces of arsenic, whilst the rest contained 0·017 to 0·136 per cent. It is estimated that the most impure of the above superphosphates, when applied at the rate of 1000 kilos. per hectare, would only furnish 0·000068 per cent. of arsenious acid in 20 cm. of soil, and, according to Sorauer, less than 0·1 per cent. of arsenious acid in the soil is harmless.

More than twenty samples of barley, malt, and beer from soil manured with superphosphate (in one case, 5000 kilos. had been applied in 12 years) were tested for arsenic. Two samples of malt showed a feeble reaction, whilst the other samples gave negative results.

The conclusion is drawn that, although superphosphate generally contains arsenic, barley manured with arsenical superphosphate does not contain more than traces, if any. The presence of appreciable amounts of arsenic in beer must therefore be due to impure glucose.

N. H. J. M.

**Value of Peat Ash as Manure.** By JOHANNES BOES (*Zeit. öffentl. Chem.*, 1902, 8, 150—151).—A sample of peat from the neighbourhood of Potsdam was found to contain 12·84 per cent. of ash of the following average composition :

K <sub>2</sub> O.	Na <sub>2</sub> O.	CaO.	MgO.	Fe <sub>2</sub> O <sub>3</sub> .	P <sub>2</sub> O <sub>5</sub> .	SO <sub>3</sub> .
0·6	0·5	40·9	0·47	4·6	1·05	4·1

N. H. J. M.

## Analytical Chemistry.

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**Gravimetric Estimation of Hydrogen Peroxide.** By GEORGE E. HOSCH (*J. Amer. Chem. Soc.*, 1902, 24, 479. Compare this vol., ii, 222).—Five c.c. of the sample are decomposed in a modified Schrötter's carbonic acid apparatus by means of a saturated solution of lead acetate; the loss in weight represents the oxygen evolved from the hydrogen peroxide alone. If the samples are acid, a weak soda solution should be employed as is done when effecting the decomposition by means of calcium hypochlorite. L. DE K.

**Volumetric Estimation of Iodides in presence of Chlorides and Bromides.** By VICTOR THOMAS (*Compt. rend.*, 1902, 134, 1141—1143).—When an excess of thallic chloride is mixed with an alkali iodide, the whole of the iodine is liberated and thalious chloride remains in solution. The iodine is expelled by boiling and the quantity of thallic salt remaining unchanged can be determined by the method previously described (this vol., ii, 357) and if the quantity originally present is known, the amount of iodine in the alkali iodide is readily calculated. The method is applicable in presence of chlorides and bromides, but in the latter case it is advisable to expel the iodine by means of a current of air, since if the liquid is boiled some bromine may be liberated. The thallic salt used in these determinations is readily recovered by converting it into thallic chloride by the action of hydrochloric acid and potassium chlorate. C. H. B.

[**Estimation of Sulphurous Acid in Dried Fruits.**] By ADOLF BEYTHIEN and PAUL BOHRISCH (*Zeit. Nahr. Genussm.*, 1902, 5, 401—409).—The amounts of sulphurous acid were estimated in various samples of dried fruits, the figures found being calculated into crystallised sodium sulphite ( $\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$ ): Californian apricots, from 0.2162 to 1.1585; Californian peaches, 0.9921; Californian pears, 0.2399; Italian prunes, 0.2367; and "Görtzer" pears, 0.2901 per cent. The dried apples and plums analysed were found to be free from sulphurous acid. The method of estimating the latter consisted in distilling in a current of carbon dioxide, after acidifying with phosphoric acid, oxidising the distillate by means of iodine, and precipitating the resulting sulphuric acid with barium chloride as usual. It was found that about one-half of the sulphite was removed from the fruits by cooking and a little more than half by soaking over-night and then cooking. W. P. S.

**Action of Sulphites on Nitroprussides.** By JUAN FAGES (*Compt. rend.*, 1902, 134, 1143—1145).—In the well-known test for sulphites, the production of the red coloration is due to the action of zinc nitroprusside on the sulphite. The product is decomposed by acids or alkalis and is stable only in presence of an excess of sulphite. Other insoluble nitroprussides behave in the same way.

as the zinc salt. Potassium ferrocyanide, which is added to increase the sensitiveness of the test, acts somewhat irregularly and seems to be beneficial chiefly because it precipitates and concentrates the red product. In presence of an excess of nitroprusside, the influence of the ferrocyanide is less marked. It can be replaced by sodium carbonate (not in excess) or any other salt which precipitates zinc without acting on the sulphite or nitroprusside or affecting the neutrality of the solution.

C. H. B.

**Estimation of Nitrous Acid in Sodium Nitrite.** By G. SCHULTZ (*Chem. Centr.*, 1902, i, 949; from *Zeit. Farben-Textil Chem.*, 1902, 1, 37—39, 149).—The accuracy of the author's process of estimating nitrous acid by means of sodium sulphanilate, which has been unfavourably criticised by Lunge, has lately been confirmed by several chemists, including Vaubel.

L. DE K.

**Rapid Estimation of Phosphorus.** By KARL RAMORINO (*Chem. Centr.*, 1902, i, 1131—1132; from *Stahl u. Eisen*, 22, 386).—A modification of Wdowiszewski's method (Abstr., 1898, ii, 454). The yellow molybdate precipitate is dissolved in 10 c.c. of approximately  $N/5$  sodium hydroxide which has been standardised with ammonium phosphomolybdate dried at  $100^{\circ}$ , and the excess of alkali is then titrated with nitric acid of corresponding strength, using phenolphthalein as indicator.

L. DE K.

**Free Acid in Superphosphate.** By JULIUS OSTERSETZER (*Chem. News*, 1902, 85, 195—196).—When titrating superphosphates with  $N/2$  or  $N/10$  sodium hydroxide, some dibasic calcium phosphate forms, and with suitable indicators intermediate tints can be observed between the stage of opalescence and that of neutrality; moreover, by the use of methyl-orange, phenolphthalein, and blue- $C_4B$ , different degrees of acidity are indicated, corresponding with the formation of mono-, di-, and tri-basic phosphates. Under some conditions, phosphoric acid appears to enter into loose combination with monobasic calcium phosphate; this is the case when the acid, in the proportion of a double molecule, is allowed to act on a quantity of the phosphate corresponding with six molecules at the ordinary temperature, or to three molecules at  $100^{\circ}$ . When tricalcium phosphate is treated with phosphoric acid in excess of the quantity required to form the monobasic phosphate, part of this excess would enter into the loose state of combination and part of it would be free; it is proposed to determine the latter by an intermediate tint with alizarinsulphonic acid, which would be observed near the point of opalescence.

D. A. L.

**Iodoeosin as Indicator in Volumetric Analysis.** By CARL GLÜCKSMANN (*Chem. Centr.*, 1902, i, 1131; from *Zeit. Oesterr. Apoth. Ver.*, 40, 390—393, Part I).—Iodoeosin is quite indifferent towards boric acid, so the amount of alkali in borax, or mixtures of it with boric acid, may be sharply titrated by means of standard hydrochloric acid, using iodoeosin as indicator. Orthophosphoric acid, when titrated with standard sodium hydroxide, behaves like a monobasic acid; barium

hydroxide cannot be employed. In titrating with this indicator, a little ether should be added to the solution. L. DE K.

**Determination of Silicon in Ferro-silicon.** By GEORGE L. NORRIS (*J. Soc. Chem. Ind.*, 1902, 21, 537).—Half a gram of the powdered ferro-silicon is dissolved in a solution of 10 grams of ferric chloride, 50 c.c. of concentrated hydrochloric acid, and about 0.5 gram of tartaric acid. A gentle heat may be applied. When the solution is completed, 25 c.c. of concentrated hydrochloric acid are added, the solution is boiled, diluted with cold water, and filtered. The residue is washed with hot dilute hydrochloric acid, then with hot water, dried, ignited, and weighed. W. P. S.

**Automatic Regulation of the Evolution of Carbon Dioxide or Nitrogen in Combustions.** By IVO DEIGLMAYR (*Ber.*, 1902, 35, 1978—1982).—A capillary and T-piece are inserted between the drying tube and the potash bulbs; the former prevents the gas passing through too rapidly. The copper oxide is heated in the usual way, but the part of the tube containing the substance mixed with copper oxide is heated by burners which are supplied from a separate tap. As soon as any pressure accumulates in the rear of the capillary, the gas supply to these burners is automatically reduced or cut off by a mercury valve connected with the T-piece. With this arrangement, it is stated that the combustion regulates itself, and that the operator need only be present when it is required to turn on the supply of oxygen or air. T. M. L.

**Estimation of Potassium in Beets, Oats, Potatoes, and Ash of Plants.** By A. BOES (*Chem Centr.*, 1902, i, 1026; from *Apoth. Zeit.*, 17, 201).—Eight grams (or less) of the material are burnt, the char is exhausted with hydrochloric acid, silica is separated as usual, also matters precipitable by barium hydroxide. After removal of the excess of barium by ammonium carbonate, the alkali chlorides are obtained by evaporation and ignition, and the potassium is then estimated as usual by means of platinic chloride. L. DE K.

**The Indirect Estimation of Alkalis in Waters.** By WALTER W. FISHER (*Analyst*, 1902, 27, 137—139).—The difference between the molecular totals of the acids and of the bases, other than potash and soda, gives a close approximation to the molecular amount of alkali present in the water. The molecular proportions of the several acids and bases are first obtained by dividing the quantities of each by their molecular weights. On multiplying the amount of alkali so found by 62, the actual weight of sodium oxide is obtained. W. P. S.

**Analyses required for Electrical Alkali Works.** By J. H. JAMES and J. C. RITCHEY (*J. Amer. Chem. Soc.*, 1902, 24, 469—475).—Directions are given for the testing of limestone, slaked lime, salt, water, caustic liquor, spent brine, chlorine gas, caustic soda, and bleaching powder. L. DE K.



**Volumetric Estimation of Zinc: a New Indicator.** By EUGÈNE PROTHIÈRE (*J. Pharm. Chim.*, 1902, [vi], 15, 419—422).—In the volumetric estimation of zinc by means of sodium sulphide, it has been customary to use lead acetate as indicator. As this salt, however, undergoes double decomposition with zinc sulphide, the estimation is not sharp. The author therefore recommends the use of antimony, in the form of tartar emetic, as indicator, whereby very sharp titrations are obtained. A. F.

**Electrolytic Deposition of Lead from a Phosphoric Acid Solution.** By ALVIN F. LINN (*J. Amer. Chem. Soc.*, 1902, 24, 435—439).—The lead solution, which should not contain more than 0.1 gram of the metal, is mixed with 10 c.c. of a solution of sodium hydrogen phosphate and the precipitate is dissolved by adding 12—14 c.c. of phosphoric acid of sp. gr. 1.71. After diluting to 130 c.c., the metal may be completely deposited by electrolysis in 12—14 hours, using a current having  $ND_{3_{100}} = 0.003$  ampere and voltage 3.

Although manganese by itself is not precipitated under these conditions, it seems to partially deposit in the presence of lead.

L. DE K.

**Estimation of Copper by Aluminium Foil.** By GEORGE E. PERKINS (*J. Amer. Chem. Soc.*, 1902, 24, 478).—The nitric acid solution of the copper ore is evaporated with large excess of sulphuric acid until dense white fumes appear. After diluting the residue with five times its bulk of water, the liquid is boiled with a few pieces of sheet aluminium, which rapidly precipitates the copper as metal; this may then be washed with water, finally with alcohol, and collected on a tared Gooch asbestos filter.

L. DE K.

**Toxicological Detection of Mercury.** By DIOSCORIDE VITALI (*Chem. Centr.*, 1902, i, 1075; from *Boll. Chim. Farm.*, 41, 149—153).—The author states that on boiling the black precipitate produced by hydrogen sulphide (when applying Fresenius and Babo's process) with nitric acid, a white substance was obtained, which, on closer investigation, proved to be the compound of mercuric nitrate with mercuric sulphide described by Rose and Barfoed. It is therefore advisable to test any such white precipitate, not only for lead, but also for mercury.

L. DE K.

**Volumetric Estimation of Mercury and also of Silver and Mercury.** By ERWIN RUPP and LUDWIG KRAUSS (*Ber.*, 1902, 35, 2015—2017. Compare R. Cohn, this vol., ii, 50).—Cohn's method, titration of mercury salts by the aid of ammonium thiocyanate in the presence of iron alum, yields good results when excess of nitric acid is present. The method is not applicable for the estimation of mercuric chloride. For the estimation of silver and mercury in the same solution, the sum of the two is first determined by the above method and then the silver estimated separately by the Gay-Lussac shaking method with  $N/10$  sodium chloride.

J. J. S.

**Colorimetric Estimation of Mercury in Urine.** By FRIEDRICH ESCHBAUM (*Chem. Centr.*, 1902, i, 1133—1134; from *Pharm. Zeit.*, 47, 260—261. Compare Abstr., 1900, ii, 368).—The method is intended for the estimation of quantities of mercury so small as to be scarcely weighable. The copper gauze containing the mercury obtained in the usual way from 200—2000 c.c. of urine is well washed with alcohol and ether and dried for half-an-hour in the air. It is then heated in a loosely corked tube so as to sublime the mercury. The tube is then divided into two parts by the usual blow-pipe manipulation. The tube containing the mercurial deposit is placed in hot water and rinsed a few times with 1—2 c.c. of chlorine water. The solution is evaporated to about 0.5 c.c., filtered into a tube having a mark at 1 c.c., and the dish and filter are then rinsed with a few drops of water. One drop of solution of stannous chloride is added, and the turbidity thus produced is compared with that of a very weak solution of mercuric chloride of known strength treated with stannous chloride in the same manner.

L. DE K.

**Volumetric Estimation of Alumina, and of Free and Combined Sulphuric Acid in Alums.** By ALFRED H. WHITE (*J. Amer. Chem. Soc.*, 1902, 24, 457—466).—Three grams of commercial alum are dissolved in 100 c.c. of water. To 25 c.c. of this are added 50 c.c. of a neutral 10 per cent. solution of potassium sodium tartrate, and the liquid is titrated with  $N/5$  barium hydroxide, using phenolphthalein as indicator. The result represents the sum of the alumina and combined and free sulphuric acid. Another 25 c.c. are evaporated to dryness on the water-bath, and the residue, after being redissolved in 50 c.c. of a neutral 10 per cent. solution of sodium citrate, is again titrated. The difference between the two titrations is equivalent to one-third of the sulphuric acid combined with aluminium, and, consequently, to one-third of the aluminium present. In this process, the precipitation of barium sulphate is retarded for a considerable time.

L. DE K.

**Modification of Rose's Method of Separating Cobalt and Nickel.** By ROBERT L. TAYLOR (*Proc. Man. Phil. Soc.*, 1902, 46, No. 11, 1—7).—Rose's original process, as is well known, consists in saturating the dilute solution of the two metals, which should contain free hydrochloric acid, with chlorine, and precipitating the cobalt as sesquioxide by adding an excess of barium carbonate. The precipitation is, however, very slow, and this, according to the author, is caused by the presence of the liberated carbon dioxide.

The modification now proposed is as follows: the liquid containing the cobalt and nickel is freed from excess of acid by evaporation, or, more conveniently, by boiling for a short time with an excess of barium carbonate, and when cold an excess of bromine water is added. After 10 minutes, the cobalt has separated quantitatively as sesquioxide. The method is equally useful in qualitative work.

L. DE K.

**Estimation of Titanium.** By GEORGE B. WATERHOUSE (*Chem. News*, 1902, 85, 198—199).—To estimate titanium gravimetrically in

steels or pig-irons, 5 grams of drillings are dissolved by warming with 50 c.c. of strong hydrochloric acid, and the solution is boiled, evaporated to dryness, and well baked. It is then treated with 20 c.c. of hydrochloric acid, heated, and the iron chloride removed by boiling with 70 c.c. of water, washing with warm 1:1-hydrochloric acid, and with cold water. The solution is made up to 150 c.c. with water, neutralised with dilute ammonia, any precipitate dissolved by a few drops of hydrochloric acid, and the whole reduced by slowly treating with 50 c.c. of a 1:5 solution of sodium sulphite with the aid, if necessary, of a little dilute sulphuric acid. The reduced solution is mixed at the boiling point with 50 c.c. of glacial acetic acid, and with a hot, filtered solution containing 20 grams of sodium acetate, boiled briskly for 15 minutes, and filtered. The precipitate, along with the residue from the first treatment with hydrochloric acid and water, is dried, ignited, and fused with 10 grams of sodium carbonate; the mass, when cold, is digested with 150 c.c. of hot water, and the washed residue boiled briskly with 10 c.c. of dilute sulphuric acid until heavy fumes are evolved; when cool, 50 c.c. of water are added, the solution filtered, made up to 150 c.c., and dilute ammonia added until a faint precipitate is permanently formed. This is redissolved as before and the treatment with sodium sulphite repeated, using 20 c.c.; the reduced solution is heated to boiling, mixed with sodium acetate and acetic acid as before, boiled for 15 minutes, and the precipitate washed, dried, ignited, and weighed as titanio oxide. The method has proved satisfactory in the presence of chromium, aluminium, nickel, tungsten, molybdenum, and vanadium.

D. A. L.

**Electrolytic Estimation of Vanadium.** By P. TRUCHOT (*Ann. Chim. anal.*, 1902, 7, 165—167).—The compound containing about 0.012—0.05 gram of vanadium pentoxide is fused with sodium carbonate, the mass is dissolved in cold water, very slightly acidified with dilute sulphuric acid, boiled to expel carbon dioxide, diluted to 200 c.c., and rendered alkaline with 20—30 drops of ammonia. After heating to 85—90°, the liquid is submitted for 8—10 hours to electrolysis, using at first a current of 2.5 volts and 0.15 ampere, and towards the end one of 0.3 ampere. Care should be taken that the alkaline reaction of the liquid is maintained during the electrolysis. The vanadium is deposited on a weighed platinum cathode of about 80 decimetres square as hydrated oxide, which is afterwards converted into pentoxide by ignition in a muffle. After cooling in a desiccator, it must be quickly weighed as it is very hygroscopic.

L. DE K.

**Detection of Traces of Vanadium and its Separation from Molybdenum.** By P. TRUCHOT (*Ann. Chim. anal.*, 1902, 7, 167—168).—The smallest amount of vanadium electrolytically deposited on platinum (compare preceding abstract) may be identified by heating the spot with a pinch of potassium hydrogen sulphate and then dissolving in a few drops of sulphuric acid, when a yellow solution will be obtained. If now a few crystals of strychnine sulphate are added, a bluish-violet coloration is obtained which turns to a bright rose. The action of some other alkaloids and phenols is as follows: atropine,

caffeine, and santonin, no effect; phenol gives a dark green, and pyrogallol a brownish-black colour.

*Separation of Vanadium from Molybdenum.*—The author states that molybdenum forms a deposit on platinum similar to that of vanadium, but it may be completely volatilised by heating to redness for about half-an-hour.  
L. DE K.

*Analysis of an Alloy containing Antimony, Tin, and Copper, also Iron and Lead.* By PONTIO (*Ann. Chim. anal.*, 1902, 7, 163—164).—Five grams of the alloy are dissolved in excess of hydrochloric acid and a few drops of strong nitric acid and diluted with water to 1 litre. (If on adding the water the liquid becomes turbid, more hydrochloric acid should be added.) One hundred c.c. of the solution are evaporated to about 5 c.c. and then boiled for 20—25 minutes with addition of 50 c.c. of fuming nitric acid and a few grams of potassium chlorate, which causes the oxides of antimony and tin to precipitate. After adding an equal bulk of water, the cold liquid is filtered, the oxides are washed with hot water acidified with nitric acid, dried, ignited, and weighed. They are then digested with 50 c.c. of dilute hydrochloric acid (3:1) and a strip of pure tin. When the tin has dissolved, the metallic antimony is collected on a tared filter, washed first with boiling water, then with alcohol, dried at 110°, and weighed. Its weight multiplied by 1.26 represents the antimony tetroxide contained in the mixed oxides; the difference consists of tin dioxide which is then calculated into tin.

The filtrate from the tin and antimony oxides is evaporated to dryness, the residue boiled with dilute hydrochloric acid and (? after neutralisation) mixed with excess of hot concentrated solution of sodium sulphide; the sulphides are washed with dilute sodium sulphide, redissolved in nitric acid, and evaporated with sulphuric acid. The lead sulphate is collected as usual and weighed. The filtrate containing the copper and iron is concentrated by evaporation and the copper determined electrolytically, using a current of 2 volts and 0.5 ampere. The iron is then estimated in the filtrate by precipitation with ammonia. In default of electrical appliances, the iron may also be separated from the copper by repeated precipitation with ammonia. The ammoniacal solution is then acidified with hydrochloric acid, the copper precipitated with pure zinc, and then converted by ignition into oxide.  
L. DE K.

*Electrolytic Determination of Bismuth.* By OTTO BRUNCK (*Ber.*, 1902, 35, 1871—1873).—Bismuth is precipitated quantitatively and in a compact form on a wire gauze electrode provided that the current density does not exceed 0.5 ampere per 100 sq. cm. for a solution containing 0.1 gram of bismuth per 100 c.c., or 0.1 ampere per 100 sq. cm. for a solution containing 0.05 gram per 100 c.c. The best method is to dissolve the metal or compound in enough nitric acid to prevent the separation of basic salts on diluting to 100 c.c., to electrolyse with an *E.M.F.* of only 2 volts from a battery of accumulators in parallel, and to start the electrolysis at 70—80°, allowing the solution to cool gradually so as automatically to reduce current-density



as the solution becomes more dilute. The method does not suffice to separate bismuth and lead, for the lead peroxide which separates at the anode always contains bismuth. The maximum error recorded for solutions of pure bismuth is 0.0005 gram on 0.01 gram of bismuth.

T. M. L.

**Iodometric Estimation of Gold.** By ERWIN RUPP and SPIESS (*Ber.*, 1902, 35, 2011—2015).—The method is based on the reduction of gold chloride by arsenious oxide according to the equation  $3\text{As}_2\text{O}_3 + 4\text{AuCl}_3 + 6\text{H}_2\text{O} = 3\text{As}_2\text{O}_5 + 12\text{HCl} + 4\text{Au}$ . A hydrochloric acid solution of auric chloride free from nitric acid is mixed with an excess of *N*/10 arsenious oxide solution and warmed on the water-bath until quite clear. Excess of sodium hydrogen carbonate is added and the unaltered arsenious oxide titrated with standard iodine solution. Alkalis, ammonia, and alkali carbonates must not be present in the gold solution.

It is stated that the Gooch-Morley direct method of titration (*Abstr.*, 1900, ii, 110) gives too high results, probably due to the spontaneous reduction of the aurous iodide and the liberation of a further quantity of iodine.

J. J. S.

**Application of the  $\beta$ -Naphthylhydrazones to the Detection and Separation of the Sugars.** By ALBERT HILGER and S. ROTHENFUSSER (*Ber.*, 1902, 35, 1841—1845).—Galactose  $\beta$ -naphthylhydrazone, best prepared by adding a concentrated aqueous solution of the sugar to an alcoholic solution of the hydrazine, melts at 189—190° and has the solubility 0.0932 per cent. in 96 per cent. alcohol. Dextrose- $\beta$ -naphthylhydrazone melts at 178—179° and has the solubility 0.896 in 96 per cent. alcohol. Arabinose- $\beta$ -naphthylhydrazone melts at 176—177° and has the solubility 0.1816 in 96 per cent. alcohol. The physical data differ from those ascribed to the same compounds by Lobry de Bruyn and Alberda van Ekenstein (*Abstr.*, 1896, i, 588), who prepared their compounds in aqueous solution but probably did not obtain them pure, this solvent being unsuitable. To separate a mixture of the three sugars, the arabinose is first removed as the phenylbenzylhydrazone; the excess of the phenylbenzylhydrazine is removed by addition of formaldehyde and the excess of the latter by evaporation. In the filtrate, the galactose may be precipitated by  $\beta$ -naphthylhydrazone, the excess of which is then removed by formaldehyde. Finally, the dextrose may be precipitated by diphenylhydrazine. The galactose may also be removed before the arabinose. The extraction of the formaldehyde- $\beta$ -naphthylhydrazone from the filtrate containing dextrose must be effected with ethyl acetate, ether being unsuitable.

A. H.

**Analysis and Testing of Kiln-dried Malt.** By EUGEN PRIOR (*Zeit. angew. Chem.*, 1902, 15, 455—462).—It is recommended that the scheme of the analysis of malt should include the following items; no novel analytical processes are given or required.

Colour of the 10 per cent. solution expressed in *N*/100 iodine; number of minutes required for saccharification. *Calculated on dry substance.*—Amount of diastase, extract, total invertable substances

(expressed as starch), pre-existing inverted substances (expressed as starch), total maltose, maltose in 100 parts of extract, maltose in the pre-existing inverted substances, total dextrin value, dextrin in the pre-existing inverted substances, starch inverted by diastase, maltose formed by diastase, dextrin formed by diastase, diastase present for 100 parts of starch, amount of starch inverted, and amount of maltose and dextrin formed by the action of 1 gram of diastase, amount of starch inverted by 1 gram of diastase in 10 minutes, relation between 1 part of total dextrin and maltose, relation between 1 part of dextrin produced by diastase and maltose, lactic acid, and appearance of the wort.

The physical properties include weight per hectolitre, amount of glassy grains, hard grains, brown grains, and white, mealy grains. Analyses of 20 different malts are communicated in a table.

L. DE K.

**A Sensitive Test for the Detection of Formaldehyde.** By CARL ARNOLD and CURT MENTZEL (*Zeit. Nahr. Genussm.*, 1902, 5, 353—356).—To detect the presence of formaldehyde in meat, butter, or milk, from 5 to 10 grams of these articles of food are extracted with 10 c.c. of absolute alcohol. After filtering, 5 c.c. of the alcoholic filtrate are mixed in a test-tube with 0.03 gram of phenylhydrazine hydrochloride, 4 drops of ferric chloride solution, and 10 drops of concentrated sulphuric acid. The solution is kept cool during the addition of the latter. Should formaldehyde be present, the solution is coloured red, whilst in the absence of this preservative it remains yellow. The test is applicable directly to light coloured beers. In the case of dark beers, the coloration may be observed in the froth produced on shaking the contents of the test-tube, or the red-colouring matter may be extracted with ether, and the latter evaporated. On adding alcohol and sulphuric acid to the residue, the red coloration reappears. The sensitiveness of the test is about 1:10,000.

W. P. S.

**Estimation of Tartaric Acid in Grape Marc.** By C. EHLMANN and H. LOVAR (*Chem. Centr.*, 1902, i, 1028; from *Oesterr. Chem. Zeit.*, 5, 121—124).—One hundred grams of the comminuted material are mixed in a counterpoised flask with 20 c.c. of hydrochloric acid of sp. gr. 1.1, and the weight of the liquid is then increased by dilution with water to 950 grams. After heating in a boiling water bath for  $1\frac{1}{2}$  hours, the loss by evaporation is restored and the liquid is filtered. Five hundred c.c. of the filtrate are evaporated in a porcelain dish to 100 c.c., mixed with 35 c.c. of a 20 per cent. solution of potassium carbonate, and boiled for some time. When cold, the liquid is diluted to 200 c.c. and filtered, and 100 c.c. are then evaporated to 15 c.c. While still hot, the dish is covered with a watch glass and 3 c.c. of glacial acetic acid are introduced. The further details are those of the process communicated by Goldenberg, Géromont and Co. (*Abstr.*, 1898, ii, 465, 545). In calculating the result of the titration, it is assumed that the marc contains 50 per cent. of water, if, however, this is not the case, a slight correction should be made.

Efforts are being made to use the Halenke-Möslinger process for

the estimation of total tartaric acid, but the experiments have not yet been concluded. L. DE K.

**Estimation of Total Tartaric Acid in Lees and Tartars.** By A. HUBERT (*Ann. Chim. anal.*, 1902, 7, 168—174).—A modification of the Goldenberg method, in which the lees or the tartars are dissolved in dilute hydrochloric acid (1 : 3), boiled with excess of potassium carbonate, and precipitated with acetic acid and excess of alcohol. The potassium hydrogen tartrate, after being washed with alcohol, is finally titrated with  $N/2$  sodium hydroxide, using phenolphthalein as indicator.

In order to obtain accurate results, a correction is necessary. Starting from 6 grams of material and 200 c.c. of dilute acid, using a plated filter of 10 cm. in diameter and carefully measuring the filtrate, 50 c.c. of which are used for the estimation, the true percentage of tartaric acid will be obtained by means of the formula  $[A + (200 - A)/2]/200 \times B$ , in which  $A$  is the volume of the filtrate *plus* 1 c.c. and  $B$  the percentage of tartaric acid as found by titration.

Drawings are given of suitable shaking apparatus when dissolving the samples in dilute hydrochloric acid. An apparatus is also described in which the hydrochloric acid solution of the sample is precipitated with a solution of calcium acetate. The height of the column of calcium tartrate then indicates at once the percentage of tartaric acid.

L. DE K.

**Test for the Gumming Quality of Lubricating Oils.** By AUGUSTUS H. GILL (*J. Amer. Chem. Soc.*, 1902, 24, 467—468).—The author employs the elaidin test for judging the quality of lubricating oils. Five grams of the sample are stirred with 11 grams of nitro-sulphuric acid (prepared by saturating sulphuric acid of sp. gr. 1.47 containing a few drops of nitric acid with nitric oxide at 0°). In the case of bad oils, brown masses form around the edges and become red in a few hours. The quality of the oils may also be judged by the amount of oxygen absorbed on heating. This is determined by heating the sample in a sealed tube for at least 100 hours and then breaking the point under water. The volume of water entering the tube represents the volume of the oxygen absorbed. Several results are given in a table.

L. DE K.

**Analytical Constants of Neatsfoot, Tallow, and Horse Oils.** By AUGUSTUS H. GILL and ALLAN W. ROWE (*J. Amer. Chem. Soc.*, 1902, 24, 466—467).—Tables giving the results of the testing of five samples of neatsfoot oil, three of tallow oil, and five of horse oil, all supposed to be genuine.

The examination included sp. gr. at 15°, Valenta test using 100 per cent. acetic acid, Maumené test using 100 per cent. sulphuric acid, specific temperature reaction, iodine number (4 hours' action), Lewkowitsch titre test and iodine number of the fatty acids.

The figures obtained with the neatsfoot oils are fairly, and those with the tallow oils remarkably, concordant, but those with the horse oils show considerable variation, the Valenta test being here of no use whatsoever.

L. DE K.

**Metallic Soaps from Linseed Oil and their Solubility in certain Hydrocarbons.** By HERMANN T. VULTÉ and HARRIET W. GIBSON (*J. Amer. Chem. Soc.*, 1902, 24, 215—222).—Starting with the sodium soap from pure linseed oil, the authors have prepared by double decomposition the soaps of lead, mercury (mercuric), copper, tin (? stannous), antimony, iron (ferrous), chromium, aluminium, nickel, cobalt, manganese, zinc, barium, and calcium, and investigated the solubility of these compounds after 1, 24, and 48 hours' immersion in the following solvents: light petroleum, sp. gr. 0.639, b. p. 35—55°; ditto, sp. gr. 0.702, b. p. 55—75°; ditto, sp. gr. 0.695, b. p. 75—85°; ditto, sp. gr. 0.698, b. p. 71°; naphtha, sp. gr. 0.741, b. p. 59°; ditto, sp. gr. 0.732, b. p. 62°; gasoline, sp. gr. 0.699, b. p. 74°; turpentine, sp. gr. 0.855. From the results which have been duly tabulated it will be seen that lead soap deposits almost completely within an hour from its solution in any of the petroleum solvents; nickel soap, although nearly completely separating in time, remains in solution for several days; iron soap is permanently soluble and an excellent drier, whilst manganese soap is unsurpassed in its drying properties.

So far as it has been carried, the investigation discloses the following facts: (1) The percentage of separation of the metallic soaps of linseed oil in the hydrocarbon solvents differs with the nature of the solvent and the linoleate. (2) Each soap affords a maximum percentage of solubility in some special hydrocarbon, and therefore no general solvent can be used for all metals. (3) The time at which the maximum separation takes place varies with the metal employed. L. DE K.

**The Bechi Test for Cottonseed Oil.** By AUGUSTUS H. GILL and CHARLES H. DENNISON (*J. Amer. Chem. Soc.*, 1902, 24, 397—398).—The evidence obtained by the authors tends to show that the coloration produced by some oils with the Bechi test is due to a sulphur compound in the oil itself. In view of the fact that substances of an aldehydic character could not be detected in the oil either by the magenta aldehyde reagent, by sodium hydrogen sulphite, or by ammonia, it is not likely that they are present. In two instances, however, the black compound formed in the test gave off hydrogen sulphide.

W. P. S.

**Detection of Sesamé Oil in Chocolate.** By FRANZ UTZ (*Chem. Zeit.*, 1902, 26, 309).—Attention is called to the fact that the active principle of sesamé oil suffers decomposition on heating, and that it is therefore of great importance not to submit the ethereal extract of the chocolate to prolonged heating or to too high a temperature (compare Posetto, Abstr., 1901, ii, 703).

The author prefers Soltsien's stannous chloride reaction to Baudouin's hydrochloric acid sugar test.

L. DE K.

**Application of Gerber's Method of Fat Estimation to Sheep's Milk.** By C. BEGER and H. WOLFS (*Chem. Zeit.*, 1902, 26, 309).—As the result of 61 experiments, it is stated that the fat in sheep's milk may be estimated with great accuracy by using Gerber's apparatus, which has found such a wide application in ordinary milk analysis.

L. DE K.



**Micro-chemical Detection of Alkaloids.** By M. EMM. POZZI-ESCOT (*Ann. Chim. anal.*, 1902, 7, 125. Compare Abstr., 1901, ii, 432, 485).—In reply to many inquiries, the author still adheres to his opinion that the micro-chemical detection of alkaloids cannot, as yet be trusted in serious investigations.  
L. DE K.

**Estimation of Alkaloids in Kola Nut and its Fluid Extracts.** By J. WARIN (*J. Pharm. Chim.*, 1902, [vi], 15, 373—377).—The residue obtained by the evaporation of the alcohol from 15 grams of the fluid extract to be analysed are triturated with 10 grams of calcined magnesia and 2 grams of water. After leaving the mixture for some time, it is placed in a dry flask, together with 150 c.c. of chloroform, and the mixture boiled under a reflux condenser for 3/4 hour. The flask must be weighed before and after heating, and any loss of chloroform must be made good by a corresponding addition of this liquid. The chloroform solution is now filtered, and the residue left by evaporation of a known volume is weighed. This gives the amount of crude alkaloid present, and if greater accuracy is desired the crude residue must be purified by solution in hydrochloric acid and subsequent solution in chloroform after precipitation with ammonia.

In the case of kola nut, 15 grams of the powder are triturated with 10 grams of calcined magnesia and 15 c.c. of water, and the estimation then carried out as above.  
H. R. LE S.

**Detection of Aloin, Tyrosine, Loganin, Opium Preparations, Tincture of Cachou.** By ÉMILE BOURQUELOT (*J. Pharm. Chim.*, 1902, [vi], 15, 342—345. Compare Abstr., 1900, i, 512; ii, 583).—If to a solution of commercial aloin a few drops of a mixture of 1 part *Russula delica* extract and 2 parts of glycerol be added, a purple-red coloration is produced. If, however, the isobarbaloin be removed from the commercial aloin by recrystallisation, then no such colour reaction takes place.

Hirschsohn's test (*Pharm. Centralhalle*, 42, 63) is very suitable for the detection of tyrosine.

This paper also contains modifications of the tests employed for the detection of loganin, opium preparations, and tincture of cachou, for the details of which the original communication must be consulted.

H. R. LE S.

**Note on Reichard's "Silver" Method for the Estimation of Morphine in Opium.** By PHILIP SCHUDROWITZ (*Analyst*, 1902, 27, 117—118).—The results of the experiments described in this paper show that the quantity of silver reduced in the estimation of morphine by Reichard's process (see Abstr., 1901, ii, 707) is largely dependent on the quantity of silver solution employed. In its present form, the method must be regarded as useless.  
W. P. S.

**Estimation of Essence of Mustard.** By P. ROESER (*J. Pharm. Chim.*, 1902, [vi], 15, 361—364).—The methods used for the estimation of essence of mustard in natural or artificial essential oils are based on the formation of silver sulphide by the action of an ammoniacal

solution of silver nitrate on thiosinamine, which last is readily produced by the action of ammonia on the mustard oil. The following method is based on Denigès's cyanide method for the estimation of silver. Five c.c. of a 1 per cent. solution of the mustard oil in alcohol (95°) are mixed with 10 c.c. of ammonia solution and 10 c.c. of *N*/10 silver nitrate and the mixture repeatedly shaken. After 24 hours, the mixture is diluted to 100 c.c., filtered, and 5 c.c. of *N*/10 potassium cyanide added to 50 c.c. of the filtrate. The excess of potassium cyanide is then titrated with *N*/10 silver nitrate in the presence of 8 drops of a slightly ammoniacal solution of potassium iodide (1/20). If, now, the number of c.c. of silver nitrate actually required be multiplied by 2 and by 17, the product is the quantity of silver nitrate actually converted into silver sulphide. The last number, when multiplied by 0.7294, gives the amount of silver sulphide formed, which, when multiplied by the factor 0.4301, gives the actual amount of mustard oil present in the 5 c.c. originally taken.

H. R. LE S.

**Characterisation of Aloes and their Detection in Pharmaceutical Preparations.** By EUGÈNE LÉGER (*J. Pharm. Chim.*, 1902, [vi], 15, 335—341).—Sodium peroxide, when added to a solution of aloes maintained at 80°, produces first a brown coloration, which, as the addition of the peroxide proceeds, becomes a beautiful cherry-red. The production of this cherry-red colour is a very delicate test for the presence of aloes. If the solution to be tested is coloured by such substances as rhubarb, emodin, &c., it is necessary to remove these by means of basic lead acetate before adding the sodium peroxide.

H. R. LE S.

**Analysis of Rubber-Wares.** By FRITZ FRANK and ED. MARCKWALD (*Chem. Zeit.*, 1902, 26, 335).—A criticism of the method proposed by Heintz (this vol., ii, 369). It is stated that the admixed organic substances are difficult of extraction unless the fillings are first removed. The alkali used to extract the "factis" can only be removed by long treatment with boiling water, and the residue is difficult to dry. Objections are also raised to the method employed for the estimation of the organic hydrogen and to the factor used in the calculation; moreover, a hydrogen estimation does not suffice, but should be supplemented by a carbon determination. Volatile mineral substances also interfere with the process.

L. DE K.

## General and Physical Chemistry.

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**Action of Light.** By ANDREA ARCHETTI (*Chem. Zeit.*, 1902, 26, 555).—Chloroform reduces Fehling's solution when the mixture is exposed to diffused light. On exposure to direct sunlight, glycerol slowly reduces mercuric chloride to mercurous chloride and finally to mercury, and ferric chloride to ferrous chloride, becoming itself converted into a substance which reduces Crismer's aldehyde reagent and dissolves ferric hydroxide in presence of excess of alkali. G. Y.

**Kinetics of Photochemical Reactions.** Oxidation of Quinine by Chromic Acid. By EMANUEL GOLDBERG (*Zeit. physikal. Chem.*, 1902, 41, 1—10).—The above reaction, which proceeds in the dark with extreme slowness, has been studied quantitatively, the extent of oxidation at any time being determined by running a certain volume of the reaction mixture into potassium iodide and titrating with sodium thiosulphate. In all the experiments, the quinine was in excess, and only the first stages of the process were studied, because of the colour changes involved. The oxidation is accelerated chiefly by the blue and violet rays,—an observation in accordance with Vogel's law that only those rays which are absorbed can be chemically active. It has been found also, in accordance with Bunsen and Roscoe's law, that the chemical action or accelerating influence of the light is proportional to its intensity. The oxidation of quinine by chromic acid is apparently a unimolecular reaction, but when the variation of the light intensity with the concentration is taken into account, it is found to be bimolecular. The author argues on various grounds that the mechanism of photochemical reactions in the light is quite distinct from what it is in the dark. Thus when the mixture of quinine and chromic acid is (1) kept hot in the dark, (2) kept cool in the light, quite different products appear to be formed in the two cases. Again, in this and other photochemical reactions, the temperature coefficient of the velocity constant is extremely small compared with that of ordinary reactions the progress of which is not affected by light. J. C. P.

**Gas Elements.** By RICHARD LORENZ (*Zeit. anorg. Chem.*, 1902, 31, 275—278).—In reply to Bose's criticism (this vol., ii, 375) of Czepinski's work on gas elements (this vol., ii, 298) the reversible nature of the oxygen | hydrogen cell is discussed. The author also discusses in more detail the four kinds of gas electrode potentials already dealt with (*Zeit. anorg. Chem.*, 1899, 20, 420). (a) At the electrode, an electromotive active gas may pass into the ionic condition; (b) an electromotive active gas may be mixed with an inactive gas at the electrode (compare Czepinski, *loc. cit.*), and in this case the action depends on the partial pressure of the active gas and permits of the construction of gas concentration elements; (c) an electromotive active gas may be mixed with an inactive gas which is, however, not

chemically indifferent; in this instance, not only the partial pressure of the active gas but also the chemical equilibrium must be taken into account; and (*d*) when there is a mixture of active gases at the electrode, the potential established may be termed a "mixed potential."  
J. McC.

**Inversion of Zinc Sulphate. II.** By H. T. BARNES and H. L. COOKE (*J. Physical Chem.*, 1902, 6, 172—177).—The temperature of inversion of zinc sulphate determined by the electrical method (that is, in a Clark's cell), differs considerably from that obtained by solubility measurements, and the difference has been ascribed to the presence of the mercurous sulphate in the Clark cell, by which the inversion temperature is lowered. A cell was therefore constructed of H-pattern, containing zinc sulphate over a 10 per cent. zinc amalgam, and it was found that the inversion temperature was still lower than that derived from the solubility, and was almost unaffected by the addition of mercurous sulphate. The cause of the difference cannot, therefore, be ascribed to the presence of the mercurous sulphate (Abstr., 1900, ii, 254).  
L. M. J.

**Electrical Resistance of Metallic Sulphides.** By JOSEPH GUINCHANT (*Compt. rend.*, 1902, 134, 1224—1225).—The author has determined the electrical resistance of previously fused metallic sulphides at various temperatures between  $-25^{\circ}$  and  $920^{\circ}$ . The resistance of lead sulphide between  $-25^{\circ}$  and  $100^{\circ}$  is represented by the equation  $\rho_t = 0.000928 (1 + 0.00501t)$ , and it increases with the temperature up to  $920^{\circ}$ . In the case of stannous sulphide, the resistance decreases continually with the temperature up to  $920^{\circ}$ ; between  $0^{\circ}$  and  $100^{\circ}$ , it is represented by the expression  $\rho_t = 1071 (1 - 0.00662t)$ . Ferrous sulphide behaves differently; its resistance decreases as the temperature rises, up to  $550^{\circ}$ , and then increases with the temperature until at about  $870^{\circ}$  it has the same resistance as at  $200^{\circ}$ . During cooling, the reverse changes take place, but the resistance lags somewhat behind the temperature. Between  $0^{\circ}$  and  $100^{\circ}$ , the resistance is represented by the equation  $\rho = 0.114 (1 - 0.00798t)$ . Other sulphides belong to one or other of these types, according to their conductivity. In all cases, the *rate of change* of the resistance increases with the temperature, and its value is higher the greater the resistance. With good conductors the value is always positive; with bad conductors, it is at first negative, but changes in sign when the value of the resistance has reached a certain low point. It seems probable that the sign of the coefficient of temperature depends on the magnitude of the resistance, or causes which determine it, and not on accessory phenomena such as electrolysis.  
C. H. B.

**Influence of Voltage on the Formation of Ozone.** By A. CHASSY (*Compt. rend.*, 1902, 134, 1298—1300).—When a small *E.M.F.* is applied to an ozoniser, no ozone is formed, but as the *E.M.F.* is increased, ozone begins to form at a certain point and a further rise of *E.M.F.* causes a very rapid increase in the amount of ozone formed. When the *E.M.F.* is high, the power of the current to produce ozone



is proportional to the square of the potential difference which exists between the armatures. As this law is not applicable until a certain *E.M.F.* is reached (which depends on the size of the apparatus), the author introduces the idea of a dielectric inertia to explain the irregularity.

J. McC.

**Depolarisation of the Hydrogen Electrode by Compounds of the Aromatic Series.** By A. PANCHAUD DE BOTTENS (*Zeit. Elektrochem.*, 1902, 8, 305—315, 332—346).—The difference of potential between a platinised platinum electrode saturated with hydrogen and a normal solution of sulphuric acid (or potassium hydroxide) containing some 10 per cent. of alcohol is diminished considerably by the addition of a reducible substance to the solution. The magnitude of the diminution is regarded as a measure of the facility of reduction of the compound used. The 53 compounds used gave the following diminutions of *P.D.* in acid solution. Nitroso-compounds 0.64—0.5 volt. Mononitro-compounds, 0.33—0.23 volt. Nitrosoamines and isodiazohydrates, 0.16—0.09 volt. Diazonium compounds, 0.47—0.37 volt. Normal diazotates do not depolarise. Of the dinitro-derivatives of benzene used, the ortho-compound gave the largest depolarisation; other similar regularities were not observed.

T. E.

**Electrocapillary Properties of Organic Bases and their Salts.** By A. GOUY (*Compt. rend.*, 1902, 134, 1305—1307. Compare Abstr., 1901, ii, 83, 435, 592; this vol., ii, 194).—Organic bases are the more active as their molecular complexity increases. Their salts, too, are active. The experiments were made by comparing the electrocapillary curve of a solution of sulphuric acid with that of the same solution after the addition of a base, and both against that of a solution of sodium sulphate containing mercurous sulphate. The active anion depresses the positive branch of the curve, whilst the active cation depresses the negative branch. The strong bases have almost the same curve as the salts, but that of weak bases is lower than that of the corresponding salts. The effect of the free base is mainly due to the undissociated part; the effect produced by the salts is to be attributed to the active cations. In general, non-electrolytes are more active than electrolytes.

J. McC.

**Conductivity of Aqueous Solutions of Electrolytes consisting of Univalent Ions.** By FRIEDRICH KOHLRAUSCH and H. VON STEINWEHR (*Sitzungsber. K. Akad. Wiss. Berlin*, 1902, 581—587).—The following salts were examined: Cesium chloride, thallous chloride, potassium iodide, potassium bromide, potassium thiocyanate, potassium fluoride, sodium fluoride, thallous fluoride, thallous nitrate, silver nitrate, and potassium chlorate. The behaviour of thallous chloride differs from that of the chlorides of the alkali metals; the equivalent conductivity increases more quickly with rising concentration above 0.001 *N*, and this is connected with the power of thallium of occurring in a polyvalent form. Thallous nitrate behaves quite normally, and at higher concentrations thallous fluoride is also quite normal. In dilute solution, however, thallous fluoride behaves anomalously, indicating that hydrolysis takes place.

The conductivity of very dilute solutions of silver nitrate between platinised plates increases with time, but solutions which are more than 0.01 *N* do not show this change of conductivity with time.

The conductivities of the salts examined are given in tables. From the results obtained, the following ionic mobilities at 18° are calculated: Li, 33.44; Na, 43.55; K, 64.67; Rb, 67.6; Cs, 68.2; NH<sub>4</sub>, 64.4; Tl, 66.00; Ag, 54.02; F, 46.64; Cl, 65.44; Br, 67.63; I, 66.40; SCN, 56.63; NO<sub>3</sub>, 61.78; ClO<sub>3</sub>, 55.03; and IO<sub>3</sub>, 33.87.

With the aid of the temperature coefficients now accurately known, the following ionic mobilities at 18° (previously only known at 25°) have been calculated: BrO<sub>3</sub>, 46.2; ClO<sub>4</sub>, 64.7; IO<sub>4</sub>, 47.7; MnO<sub>4</sub>, 53.4; CHO<sub>2</sub>, 46.7; C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>, 35.0; C<sub>3</sub>H<sub>5</sub>O<sub>2</sub>, 31.0; C<sub>4</sub>H<sub>7</sub>O<sub>2</sub>, 27.6; C<sub>5</sub>H<sub>9</sub>O<sub>2</sub>, 25.7; and C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>, 24.3. J. McC.

**Electrolysis of Aqueous Solutions with Platinised Electrodes and the Electrolytic Formation of Dithionates.** By FRITZ FOERSTER and A. FRIESSNER (*Ber.*, 1902, 35, 2515—2519).—When a solution of sulphuric acid or sodium hydroxide is electrolysed with platinised electrodes at a constant temperature and with the same strength of current, the difference of potential at the terminals and the anode potential gradually increases, whilst the difference (in volts) between the two remains constant. The cathode potential does not alter during the electrolysis, and the anode has the higher potential immediately the cathode becomes slightly polarised, showing that the phenomenon is due to small quantities of oxygen. This result is illustrated by the electrolysis of sodium sulphite. No oxygen escapes on the anode, and some SO<sub>3</sub> ions combine forming S<sub>2</sub>O<sub>6</sub> ions, whilst some combine with hydroxyl ions forming SO<sub>4</sub> ions and water. Several experiments are described, in the most successful of which 47 per cent. of the current was utilised in the formation of dithionate.

R. H. P.

**Velocity of Electrolytic Decomposition of Oxalic Acid in Presence of Sulphuric Acid.** By TEODOR ÅKERBERG (*Zeit. anorg. Chem.*, 1902, 31, 161—190).—When a solution of sulphuric acid containing oxalic acid is electrolysed between polished platinum electrodes, the oxalic acid is scarcely decomposed. When platinised electrodes are used, the oxalic acid is readily decomposed. The decomposition is therefore a secondary process which is catalytically influenced by the platinum black; it is a purely chemical oxidation effected by the electrolytically separated oxygen. In concentrated solution, with low current densities, or at high temperature, the decomposition follows Faraday's law, but in more dilute solution the reaction is unimolecular and consequently the oxidation is carried out by atomic oxygen. The constant for reaction velocity between 15° and 55° varies almost proportionally with the temperature. J. McC.

**Temperature of Maximum Density and Electrical Conductivity of Solutions of Barium Bromide and Iodide, and Calcium Chloride, Bromide, and Iodide.** By LOUIS C. DE COPPET and W. MULLER (*Compt. rend.*, 1902, 134, 1208—1209).—The molecular reduction of the temperature of maximum density is constant or

increases slightly, and, as in the case of the alkali metals, is least for the chlorides and greatest for the iodides. It is greater for barium salts than for the corresponding calcium salts. The molecular conductivity diminishes as the concentration of the solution increases.

C. H. B.

**Lowering of the Freezing Point of Water produced by Concentrated Solutions of Certain Electrolytes, and the Conductivity of such Solutions.** By HARRY C. JONES and FREDERICK H. GETMAN (*Amer. Chem. J.*, 1902, 27, 433—444).—The freezing point and conductivity of solutions of hydrochloric acid, nitric acid, sulphuric acid, potassium hydroxide, calcium chloride, strontium chloride, barium chloride, sodium nitrate, and potassium nitrate up to  $3N$  have been determined. Except in the cases of the last two compounds, a minimum has been found for the molecular lowering of the freezing point. The molecular conductivities increase quite regularly, showing no trace of a minimum point. The theoretical discussion is reserved for a later paper.

J. McC.

**The Temperature Coefficients of the Ions in Water. A Law applicable to the Univalent Elements.** By FRIEDRICH KOHLRAUSCH (*Sitzungsber. K. Akad. Wiss. Berlin*, 1902, 572—580).—It has already been shown (*ibid.*, 1901, 1026) that the temperature coefficient of univalent positive ions is a function of their mobility. As it appeared strange that this should apply only to positive ions, a re-investigation has been made of the negative ions and of some of the doubtful positive ions. The results indicate that the law is quite generally applicable to univalent ions and consequently the ratio of the ionic mobilities approaches the value 1 as the temperature rises.

The temperature coefficient of univalent and bivalent ions is discussed and its bearing on the Hittorf transport numbers; the influence of temperature on the transport ratio can be more accurately ascertained from these coefficients than by direct measurement.

The similar relationship for all univalent ions between mobility and temperature coefficient leads the author to a discussion of the connection between dissolved substance and solvent. The influence of temperature being the same in all cases suggests that the ion is surrounded by an envelope of water which moves with it, and this view is supported by a consideration of the electrical resistance and internal friction of solutions. This hypothesis, however, does not explain why the ions when arranged according to their mobilities fall into the series: Li, Na, Ag, K, Tl, Rb, Cs.

J. McC.

**Methods of Determining the Heat of Solution at the Point of Saturation.** By ED. VON STACKELBERG (*Zeit. physikal. Chem.*, 1902, 42, 96—100).—In reference to a paper by Holsboer (this vol., ii, 226), who prefers van Deventer's method to the author's, the latter argues in favour of his own method, and concludes that the objections to it urged by Holsboer are not valid.

J. C. P.

**Polymerisation and Heat of Formation of Zinc Oxide.** By ROBERT DE FORCRAND (*Compt. rend.*, 1902, 134, 1426—1429).—Previous determinations of the heat of formation of zinc oxide have given

values varying between 83.28 Cal. and 88.2 Cal. ( $Zn=65$ ). The author has redetermined this value by measuring the heat of dissolution of zinc in dilute sulphuric acid, and that of zinc oxide in the same acid. For zinc oxide, prepared by dehydrating the crystalline zinc hydroxide at  $125^{\circ}$  in a current of dry air, the heat of solution is 27.92 Cal.; for the oxide obtained by heating the nitrate at  $350^{\circ}$  for 4 hours, the heat of solution is 25.23 Cal.; for the oxide prepared from the precipitated hydroxide, the heat of solution is 23.91 Cal. In this case, it was necessary to heat the hydroxide at a very high temperature in order to remove the last traces of water. When zinc oxide is produced by burning zinc in oxygen, the heat of solution is 23 Cal. A determination of the heat of solution of zinc in sulphuric acid gave the value 39.31 Cal.

Hence the heat of formation of zinc oxide from solid zinc and gaseous oxygen varies from 80.29—84.7 Cal., according to the temperature which has been attained in the preparation of the oxide; the higher the temperature the greater the heat of formation.

The view is expressed that the oxide undergoes polymerisation when it is heated, and that the difference between the extreme values of the heat of formation, 4.41 Cal., expresses the heat developed in this process. A specimen of the oxide which has been heated to bright redness, whether cooled rapidly or slowly or kept for a long time, still remains in a polymerised state.

K. J. P. O.

**Ammoniacal Cupric Oxide.** By ALBERT BOUZAT (*Compt. rend.*, 1902, 134, 1310—1312).—The heat of neutralisation was determined of a solution containing 1 gram-mol. of cupric oxide and 28 mols. of ammonia in 14 litres. With 1 mol. of sulphuric acid, the heat evolved is 35.5 Cal.; with 2 mols. of hydrochloric acid, 32.1 Cal.; with 2 mols. of nitric acid, 31.8 Cal.; and with 2 mols. of acetic acid, 30.0 Cal. In each case, the heat of neutralisation is greater than the heat of neutralisation of the cupric oxide or of the ammonia alone, which proves that the acid molecule neutralises a complex base.

The heat of formation of  $CuO, 28NH_3$  (dissolved) from solid cupric oxide and ammonia solution is calculated to be about 4.2 Cal. The complex ammoniacal cupric oxide is a strong base.

J. McC.

**Melting of Binary Solid Mixtures by Cooling.** By HENDRIK W. BAKHUIS ROOZEBOOM (*Proc. K. Akad. Wetensch. Amsterdam*, 1902, 4, 636—639).—A case is cited of a binary liquid mixture which first solidifies on cooling, then partially liquefies by further fall of temperature.

Azoxyanisole at  $114^{\circ}$  passes into the condition of liquid crystals, and at  $135^{\circ}$  changes to an isotropic, clear, yellow liquid; quinol melts at  $169^{\circ}$ . In the liquid condition, these substances are completely miscible at temperatures lying above the line joining their melting points on a system of coordinates, where the composition is represented along the abscissæ and the ordinates are temperatures. Below this line, the mixing limits are represented by three straight lines, *CII*, *HK*, and *KD*. *C* is the melting point of azoxyanisole, *H* represents the temperature,  $111.6^{\circ}$ , and a mixture containing 11 mols. per



cent. of azoxyanisole,  $K$  represents  $106^{\circ}$  and a mixture of 25 mols. per cent. of azoxyanisole, and  $D$  is the melting point of quinol. The transition point of solid into liquid crystals of azoxyanisole is depressed by the addition of quinol. Starting with a mixture containing about 10 mols. per cent. of azoxyanisole at  $111.6^{\circ}$ , the formation of liquid mixed crystals first takes place; on further cooling, the mixture solidifies and then again liquefies. The second liquid formed has, however, a different composition.

If the liquid crystalline condition be considered as solid (and the author believes that there are sound reasons for this view), the above phenomenon is one of retrograde solidification.

Another case has been found by Heycock and Neville with mixtures of copper and tin.  
J. McC.

**Vacuum Distillation.** By EMIL FISCHER and CARL HARRIES (*Ber.*, 1902, 35, 2158—2162).—A mercury air pump is too slow in its action to enable distillations to be carried out satisfactorily under smaller pressures than 0.5 mm.; this disadvantage is especially marked in cases where easily volatile substances such as ether, alcohol, and hydrocarbons are present. By using a "Geryk" vacuum pump (Fleuss' patent), however, and a second receiver cooled by liquid air, wherein all ordinary vapours and gases are condensed, distillations can be readily carried out under pressures not exceeding 0.1—0.2 mm. The receiver in which the distilled substance condenses is cooled with ice and is connected directly to the distilling flask, and to the second receiver which is kept surrounded by a Dewar's vacuum vessel filled with liquid air. The pressure is measured by a MacLeod—Kahlbaum manometer. The original should be consulted for details as to the arrangement of the parts and the stopcocks; the latter are of such a nature as to allow of the receiver being changed without interrupting the vacuum.

In order to ascertain the effectiveness of the apparatus, distillations were carried out with oleic acid, stearic acid, glycerol and  $\alpha$ -methylglucoside; that the formation of gaseous decomposition products during distillation does not lower the vacuum is well shown by the results obtained on distilling dry Para rubber. On removing the vessel of liquid air, however, the pressure immediately rose from 0.2 to 15—20 mm.  
W. A. D.

**Liquefaction of Gaseous Mixtures.** By J. P. KUENEN (*Zeit. physikal. Chem.*, 1902, 41, 43—51).—A criticism in the first place of Caubet's recent paper (this vol., ii, 382), and indirectly of Duhem's theoretical work.  
J. C. P.

**Solubility of Analogous Salts.** By W. O. RABE (*Zeit. anorg. Chem.*, 1902, 31, 154—157).—Rossi has shown that the ratio between the molecular weights of two salts of the same acid containing two chemically similar metals of the same periodic group is a simple multiple of the ratio of their solubilities. The author has investigated

the solubilities of thallous nitrate, sulphate, chlorate, perchlorate, and picrate and compared them with the corresponding values for lithium, sodium, silver, and ammonium salts without finding any regularity. Comparison with potassium salts, however, shows a most striking similarity, for the molecular solubilities exhibit a very simple relationship.

As the temperature rises, the saturated solutions of thallous and potassium salts become more nearly equimolecular. As the molecular magnitude of the anion increases, there is also a tendency for the saturated solutions to become more nearly equimolecular. J. McC.

**Theory of the Velocity of Chemical Reactions.** By RUDOLF WEGSCHEIDER (*Zeit. physikal. Chem.*, 1902, 42, 62—70).—A reply to Euler (this vol., ii, 384). J. C. P.

**Relative Velocities of the Ions in Solutions of Silver Nitrate in Pyridine and Acetonitrile.** By HERMAN SCHLUNDT (*J. Physical Chem.*, 1902, 6, 159—171).—Solutions of silver nitrate in pyridine and acetonitrile were prepared, and the ion velocities determined by the analyses of the electrode liquids. The following table gives the results obtained, the values in other liquids being added for completeness; the numbers given are the transference numbers of the cation multiplied by 100 :

Solvent.	Volume in litres per gram-mol. of $\text{AgNO}_3$ .							
	0.42.	1.	2.	4.	10.	16.	35.	40.
Water .....	53.2	50.0	48.3	47.3	—	—	—	47.5
Acetonitrile .....	—	38.3	—	42.2	44.8	—	47.3	—
Pyridine .....	—	32.6	34.2	—	39.0	—	—	44.0
Methyl alcohol .....	—	—	—	—	—	53.3	—	—
Ethyl alcohol.....	—	—	—	—	40.5	49.0	—	—

It is seen that the values differ considerably but appear to converge with increasing dilution; data are not available to determine whether this is general in solutions. In aqueous solutions, the values decrease on dilution, in pyridine they increase. This increase is frequently observed in aqueous solutions in the case of compounds which form hydrates, and in this connection it is noteworthy that silver nitrate forms definite compounds with pyridine. L. M. J.

**Velocity of Formation of Simple Ethers.** By M. ROSENFELD FREIBERG (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 422—430).—In continuation of the work of Zagrebin (*ibid.*, 1898, 30, 711), the author has determined the velocities with which various alcohols act on the

esters of benzenesulphonic acid to produce simple ethers together with benzenesulphonic acid. The following table gives the velocities of reaction for the different cases :

Benzenesulphonic esters.	Alcohols.					
	Methyl.	Ethyl.	Propyl.	<i>iso</i> Butyl.	<i>iso</i> Amyl.	Octyl.
Methyl .....	3019	1562	1137	772	827	—
Ethyl .....	2311	1130	816	498	546	420
<i>iso</i> Butyl .....	584	228	171	96	115	—
<i>iso</i> Amyl .....	608	268	195	123	137	—

The relations of these numbers to the structure of the benzenesulphonic esters and to the alcohols are discussed. T. H. P.

**Saponification of the Esters of Carboxylic and Sulphonic Acids.** By RUDOLF WEGSCHEIDER (*Zeit. physikal. Chem.*, 1902, 41, 52—61).—In the author's view, the saponification of the sulphonic esters by water is not accelerated by hydrogen ions,—a contrast to the case of the carboxylic esters; acids have an accelerating influence only when they induce a secondary reaction which takes place with moderate rapidity (compare Kastle, Murrill, and Frazer, *Abstr.*, 1898, i, 140). Alkalis exert an accelerating influence on the rate of saponification, and the hydroxyl ions may be supposed either (1) to act independently of the water, or (2) to have a catalytic influence on the water.

If saponification by water is attributed in all cases to the hydroxyl ions, it is necessary to attribute an accelerating catalytic influence to the hydrogen ions; this influence in the case of the sulphonic esters is proportional to the concentration of the hydrogen ions, in the case of the carboxylic esters to the square of their concentration. The author formulates his views in a series of equations, and he finds experimental verification of them in the work of Kastle, Murrill, and Frazer (*loc. cit.*). J. C. P.

**Influence of Side Chains on the Properties of Carbon Compounds with Open or Closed Chains.** VII. Velocity of Combination of Heterocyclic Compounds with Alkyl Bromides. By NICOLAI A. MENSCHUTKIN (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 411—422).—The table on p. 494 gives the velocities of combination of allyl and methyl bromides with various derivatives of pyridine, piperidine, quinoline, and *iso*quinoline.

The author proceeds to discuss these results in comparison with those obtained with benzene compounds. Taken together with the numbers given in the author's earlier communications, those here given show that the influence of the side chain on the velocity of combination

	With $C_3H_5Br$ .	With $CH_3Br$ .		With $C_3H_5Br$ .	With $CH_3Br$ .
Pyridine .....	276	578	Quinoline .....	29	96
$\alpha$ -Picoline .....	55	213	<i>iso</i> Quinoline .....	365	645
$\beta$ -Picoline .....	435	—	Quinaldine .....	—	23
Aldehydecollidine .....	65	346	Lepidine .....	—	159
Piperidine .....	20575	35692	<i>o</i> -Toluquinoline .....	0	0
$\alpha$ -Pipcoline .....	6826	—	<i>m</i> -Toluquinoline .....	0	76
<i>d</i> -Coniine .....	2684	10485	<i>p</i> -Toluquinoline .....	34	115
$\beta$ -Pipcoline .....	28109	—	Xyloquinoline .....	0	—
			Hydroquinoline .....	300	177
			Hydro- <i>o</i> -toluquinoline ..	284	187
			Hydro- <i>m</i> -toluquinoline...	349	247
			Hydro- <i>p</i> -toluquinoline ..	610	363

of all compounds—both with open and closed chains and those containing only carbon as well as the hetero-atomic ones—with alkyl haloids exhibits uniform and analogous relations.

T. H. P.

**Influence of Constitution on the Affinity Constants of Organic Acids.** By RUDOLF WEGSCHEIDER (*Monatsh.*, 1902, 23, 287—316. Compare Abstr., 1895, ii, 310).—The author has tabulated the factors which represent the influence of various substituting groups, on the affinity constants of saturated fatty and of aromatic acids. The factors for halogens decrease generally from chlorine to iodine. For a negative substituting group in the fatty series, the factor diminishes rapidly with change of the group from the  $\alpha$ - to the  $\beta$ -position, and then slowly to the  $\delta$ -position, after which it remains almost constant. This seems to throw doubt on the usually accepted views as to the stereoproximity of the  $\gamma$ - and  $\delta$ -positions to the carboxylic group. The influence of a methyl or ethyl group in the  $\alpha$ -position is greatest when replacing a hydrogen atom of a methylene group, least when of a methenyl group; in the  $\beta$ -position an alkyl radicle has a negative influence which gradually changes to positive as the radicle is removed further from the carboxylic group; the influence of a methyl group in the benzene series varies in similar manner, becoming positive in the *meta*- and *para*-positions; hydroxyl and methoxyl show similar changes in the nature of their influence. The influence of the *ortho*-position resembles that of the  $\beta$ , of the *meta* and *para*, that of the  $\gamma$ .

The factor representing the influence of the carboxylic group is found by dividing the affinity constant of one of the carboxylic groups of a dibasic acid by the affinity constant of acetic acid; the product represents the influence of the other carboxyl as a substituting group.

Considerable differences between the calculated and the determined affinity constants are found in the case of acids of the malonic type, having a strongly negative group or no hydrogen attached to the  $\alpha$ -carbon atom, of derivatives of succinic acid in which an alkyl group has replaced a hydrogen atom of each methylene, and of aromatic acids



with substituting groups in the position 2:6 or 2:3 ( $\text{CO}_2\text{H}=1$ ), in the latter case when  $\text{NO}_2$  or  $\text{CO}_2\text{Et}=2$ . Substitution in both *ortho*-positions sometimes weakens the negative influence of the single substituting group. G. Y.

**Catalysis of Hydrazine.** By SIMEON TANATAR (*Zeit. physikal. Chem.*, 1902, 41, 37—42).—In a previous paper (this vol., ii, 386), it was shown that the catalysis of hydrazine sulphate by platinum in aqueous solution takes place according to the equation  $3\text{N}_2\text{H}_4 = 4\text{NH}_3 + \text{N}_2$ . In the present paper, it is shown that free hydrazine in aqueous solution and in the presence of platinum breaks up in the following manner:  $2\text{N}_2\text{H}_4 = 2\text{NH}_3 + \text{N}_2 + \text{H}_2$ , the evolved gas consisting of equal volumes of nitrogen and hydrogen. In the presence of sodium hydroxide the decomposition of free hydrazine is different, namely,  $3\text{N}_2\text{H}_4 = 2\text{NH}_3 + 2\text{N}_2 + 3\text{H}_2$ , the evolved gas containing 60 per cent. of hydrogen. If, however, sodium hydroxide is added to hydrazine sulphate in equivalent quantity, the evolved gas contains only 9—10 per cent. of hydrogen; if the quantity of sodium hydroxide is increased, the proportion of hydrogen rises, but only in the presence of a large excess of alkali does it amount to 60 per cent. J. C. P.

**Synthetic Analysis of Solid Phases.** By WILDER D. BANCROFT (*J. Physical Chem.*, 1902, 6, 178—184).—The determination of the composition of an alloy, which separates from mother liquor, is frequently difficult, owing to the presence of the mother liquor mixed with the crystals. The author suggests the addition of a third substance which will not enter into the alloy. Then, if the original composition is  $x_1$  grams of *A*, and  $y_1$  grams of *B* per gram of *C*, and that of the liquor is  $x_2$  grams of *A*, and  $y_2$  grams of *B* per gram of *C*, then the composition of the alloy is  $x_1 - x_2$  grams of *A* to  $y_1 - y_2$  grams of *B*. Even if the third substance forms part of the solid phase, the method is still available, as if, in a triangular diagram, points representing the initial and final concentrations of the liquor be taken, the composition of the alloy is represented by a point in the extension of the line joining the two points, and a second experiment with a different initial concentration serves to determine the alloy. The author indicates how by these means the equilibrium field of a three-component system may be investigated. L. M. J.

**Equilibria in Systems of Three Components, the Formation of Two Liquid Phases being possible.** By P. A. MEERBURG (*Zeit. physikal. Chem.*, 1902, 40, 641—688).—An investigation on the lines of Schreinemakers' work. The systems chosen were (1) triethylamine-water-ethyl alcohol; (2) triethylamine-water-ether; (3) triethylamine-water-phenol. According to Schreinemakers, the binodal curves for higher temperatures may (1) be enclosed by those for lower temperatures—as for the system water-phenol-acetone (Schreinemakers, *Abstr.*, 1900, ii, 393); or (2) enclose those for lower temperatures; an example of this latter case has been found by the author in the system amine-water-alcohol. In the other two systems investigated—amine-water-ether and amine-water-phenol—the binodal curves for different tem-

peratures cut one another and the field of heterogeneous equilibrium is displaced, as in the case of water, alcohol, and sodium sulphate, studied by de Bruyn (Abstr., 1900, ii, 266).

Full details are given of the composition of the phases in equilibrium with one another at different temperatures, and the results are expressed by the usual graphical methods.

J. C. P.

**Limitations of the Mass Law.** By WILDER D. BANCROFT (*J. Physical Chem.*, 1902, 6, 190—192).—The dissociation of a compound in solution has been deduced from that of the vapour in cases where Henry's law holds. Thus, if the solubility relations of  $AB$ ,  $A$  and  $B$  are  $c_1 = k_1 c'_1$ ,  $c_2 = k_2 c'_2$ ,  $c_3 = k_3 c'_3$ , and the equilibrium equation is  $Kc_1 = c_2 c_3$ , then for equilibrium in solution  $(K.k_1/k_2 k_3)c'_1 = c'_2 c'_3$ . The author shows, however, that this will not hold if, as is frequently the case, the solubility of  $A$  is affected by the presence of  $AB$  or  $B$ .

L. M. J.

**The so-called Negative Nature of Unsaturated Radicles.** By DANIEL VORLÄNDER (*Ber.*, 1902, 35, 2309—2313).—A reply to Henrich (this vol., ii, 449).

W. A. D.

**Relation between Crystalline Form and Molecular Structure.** By H. ZIRNGIEBL (*Zeit. Kryst. Min.*, 1902, 36, 117—150).—Various substances which show great similarity in crystalline form without being isomorphous are compared. Thus, in the replacement of the groups  $\text{CO}$  and  $\text{SO}_2$  in orthosulphobenzoic and phthalic acids, in benzenesulphonic and benzoic acids, &c., and in various salts of these; the replacement of  $\text{CH}_2$  and  $\text{NH}$  in methanedisulphonic acid and iminosulphonic acid; of oxygen and halogens in salts of iodic and fluoroiodic acids, &c. Detailed crystallographic determinations were made on many of these substances to enable the comparisons of the crystallographic axes, topic axes, &c., to be made.

L. J. S.

**A Method for Separating Crystals from Alloys.** By CORNELIS VAN EYK (*Proc. K. Akad. Wetensch. Amsterdam*, 1902, 4, 758—761).—Objection is taken to the methods which have previously been used for this purpose.

The temperature at which crystals begin to separate from the molten alloy is first determined, then about 30 grams of the alloy are placed in a hard-glass test-tube which has a capillary constriction in the centre; if necessary, a small plug of asbestos can be inserted above this. The tube is evacuated, then sealed and placed in a specially constructed electric furnace capable of heating it to the required temperature. The furnace is set in a properly adapted centrifugal machine, and after rotating it is found that the liquid part of the alloy has passed into the lower portion of the tube, whilst the crystals are retained in the upper part.

Experiments are described to prove the efficiency of the method. For temperatures up to  $300^\circ$ , no greater difference than  $2^\circ$  has been observed before and after rotation. The crystals cannot be completely freed from mother liquor, but the method easily indicates whether pure metals, compounds, or mixed crystals are deposited from the alloy.

J. McC.

**Plasticity of Clay.** By PAUL ROHLAND (*Zeit. anorg. Chem.*, 1902, 31, 158—160).—The cause of the plasticity of clay has not yet been satisfactorily explained. The author questions the mechanical explanations which have been offered; he suggests that those substances which exhibit plastic properties all contain colloids, and that the plasticity is connected with the peculiar action of water on colloidal substances.

J. McC.

**Calculation of Atomic Weights.** By JOSEF SCHMIDT (*Zeit. anorg. Chem.*, 1902, 31, 146—153).—If it be assumed that chemical attraction obeys the same laws as the attraction of bodies, a numerical series of atomic weights can be obtained. The author assumes that every chemical valency corresponds with a determinate part of the atomic weight and that the atom consists of an active part and of an inactive part. The inactive part is represented by  $a$  and each active part by  $b$ , so that the atom of an univalent element is  $a+b$  and that of a bivalent element  $a+2b$ . For the series from lithium to fluorine, the fundamental numbers are:  $a=2$ ,  $b=5$ ; for the series from sodium to chlorine,  $a=14$ ,  $b=7$ ; for the series from potassium to manganese,  $a=23$ ,  $b=12$ ; for the series from copper to bromine,  $a=36$ ,  $b=18$ . Attention is called to certain regularities with respect to these fundamental numbers. In some cases (heavy univalent elements), it is necessary to assume that the atom is weighted too much on one side by the chemical attraction and to balance this the atom contains a loosely bound excess weight which for sodium amounts to 2.

J. McC.

**The Periodic System and the Properties of Inorganic Compounds. IV. The Solubility of Double Sulphates of the Formula  $M'_2M''(SO_4)_2 \cdot 6H_2O$ .** By JAMES LOCKE (*Amer. Chem. J.*, 1902, 27, 455—481).—The salts examined contain alkali metals, except sodium and lithium, ammonium, or thallium, as  $M'$ , whilst  $M''$  was magnesium, zinc, cadmium, iron, nickel, cobalt, manganese, or copper. The solubilities do not follow the same order as the atomic weights. The influence of each metal on the solubility is specific and independent of the atomic weight; it is retained throughout all the compounds.

The relation between the solubilities of corresponding salts of any two bivalent metals can be accurately expressed by the equation  $y' = ay + 2by + c$ , where  $y$  and  $y'$  are the salts of two bivalent metals with the same univalent metal. The values for the coefficients  $a$ ,  $b$ ,  $c$  are calculated for a number of pairs of bivalent metals and with the aid of these the solubilities of other salts can be predicted. The applicability of an equation of this type proves that in a group of isomorphous compounds the effect of a given element on the solubility of its compounds in the series is constant throughout these compounds.

As these solubility relationships do not agree with the positions of the elements in the periodic arrangement, the author is of the opinion that for the systematisation of inorganic compounds a new classification is required which will properly represent the quantitative relationships and include radicles as well as elements.

J. McC.

Lecture Experiments illustrating Various Types of Catalytic Action. By ALBERT A. NOYES and G. V. SAMMET (*J. Amer. Chem. Soc.*, 1902, 24, 498—515).—Experiments are described to demonstrate the various types of catalytic action, namely, catalysis by carriers, by adsorbent contact agents, by electrolytic contact agents, by water, by dissolved electrolytes, by enzymes, and by inorganic colloids. For details, the original must be consulted. E. G.

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## Inorganic Chemistry.

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Halogen Salts. By PAUL PFEIFFER (*Zeit. anorg. Chem.*, 1902, 31, 191—234).—Werner (*Abstr.*, 1899, ii., 278) has instituted a comparison of the chloro-salts and has shown that these can be classed in one system in accordance with the theory formulated by him. In order to complete the examination, the author has collected details of all the complex bromides and iodides which have been described, and shows that these are quite analogous to the corresponding chlorides. They can be grouped in Werner's system, and it is pointed out that the existence of certain of them completely disproves Remsen's theory of double salts. A list is given of 202 bromides and 175 iodides. J. McC.

Behaviour of Hydrogen Chlorides and Fluoride towards Caro's Reagent. By EDGAR WEDEKIND (*Ber.*, 1902, 35, 2267—2269).—Caro's reagent liberates chlorine from aqueous or gaseous hydrogen chloride, and bromine from hydrogen bromide. Attempts to prepare fluorine by oxidising hydrogen fluoride with Caro's reagent under a variety of conditions gave only negative results. T. M. L.

Atomic Weight of Iodine. By ALBERT LADENBURG (*Ber.*, 1902, 35, 2275—2285).—Iodine, when purified by Stas' method, is liable to contain traces of chlorine. Three experiments on the conversion of silver iodide into chloride gave for the atomic weight of iodine the values 126.957, 126.961, 126.963, mean 126.960, with an error of  $\pm 0.0003$  ( $\text{Ag} = 107.93$ ,  $\text{Cl} = 35.45$ ), Stas' value being 126.85. A determination by converting silver into nitrate and then into iodide gave, after correcting for the chlorine in the potassium iodide, the value 126.87, but this is considered less accurate. T. M. L.

Physical Properties of Hydrogen Telluride. By ROBERT DE FORCRAND and HENRI FONZES-DIACON (*Compt. rend.* 1902, 134, 1209—1211).—Hydrogen telluride is readily obtained by the action of water, or better, of acids, and especially of metaphosphoric acid, on aluminium telluride,  $\text{Al}_2\text{Te}_3$ , which is prepared by igniting an intimate mixture of aluminium and tellurium by means of magnesium. Deter-



minations of the physical constants of the gas were made with the following results: boiling point,  $0^{\circ}$ ; melting point,  $-48^{\circ}$ ; density of the liquid, 2.57; molecular volume, 49.75. These values do not form a regular series with the corresponding values for oxygen, sulphur, and selenium.

C. H. B.

**The Densities of Mixtures of Hydrazine and Water.** By J. W. DITTO (*Proc. K. Akad. Wetensch. Amsterdam*, 1902, 4, 756—758).—The sp. gr. of a series of mixtures of hydrazine and water has been determined. Pure hydrazine has the sp. gr. 1.0114 at  $15^{\circ}/4^{\circ}$ , and as water is added the sp. gr. increases up to 1.0470, obtained when the mixture contains 64.1 per cent. of hydrazine; it then falls continuously. The composition of the liquid with maximum sp. gr. corresponds almost exactly with  $\text{N}_2\text{H}_4\cdot\text{H}_2\text{O}$ .

J. McC.

**Preparation of Gaseous Hydrogen Phosphide.** By F. BODROUX (*Bull. Soc. Chim.* 1902, [iii], 27, 568—569).—The method is essentially the same as that of Matignon (*Abstr.*, 1900, ii, 482), but the initial product is less pure and is more easily obtained. A mixture of two parts of aluminium powder and one part of red phosphorus is made and the mass inflamed; among other things, aluminium phosphide is formed. The mass is then treated with cold or lukewarm water (not above  $50^{\circ}$ ), whereby the aluminium phosphide is slowly decomposed with evolution of pure hydrogen phosphide. In this experiment, the aluminium may profitably be replaced by magnesium.

A. F.

**Atomic Weight of Arsenic.** By W. CLARENCE EBAUGH (*J. Amer. Chem. Soc.*, 1902, 24, 489—497).—Silver arsenate was converted into silver chloride by heating it in a stream of hydrogen chloride; the mean of eight determinations gave 75.004 as the atomic weight of arsenic, the probable error being  $\pm 0.012$ . The silver chloride thus obtained was reduced to silver by heating it in a current of hydrogen; from seven determinations a mean value of 74.975 was obtained, with a probable error of  $\pm 0.015$ . The results obtained by the conversion of silver arsenate into silver bromide were not mutually concordant. Eight estimations of the lead chloride produced by heating the arsenate in hydrogen chloride gave a mean value 75.022, with a probable error of  $\pm 0.009$ . The value obtained as the mean of three estimations of the lead bromide formed from lead arsenate was 75.004, with a probable error  $\pm 0.021$ . The mean value for the atomic weight of arsenic from the whole of the experiments was 75.008, and the probable error  $\pm 0.006$ . ( $\text{O} = 16.0$ )

E. G.

**Action of Hydrogen Peroxide on Sodium Arsenate ( $\text{Na}_3\text{AsO}_4$ ).** By G. I. PETRENKO (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 391—392).—The interaction of hydrogen peroxide and sodium arsenate yields a compound of the composition  $\text{Na}_9\text{As}_3\text{O}_{17}\cdot 21\text{H}_2\text{O}$ , which may be regarded as a hydrate of sodium arsenate in which part of the water is replaced by hydrogen peroxide:  $3\text{Na}_3\text{AsO}_4\cdot 5\text{H}_2\text{O}_2\cdot 16\text{H}_2\text{O}$ .

T. H. P.

**Method of Collecting Solid Carbon Dioxide for Lecture Purposes.** By CHARLES R. DARLING (*Chem. News*, 1902, 85, 301—302).—A flannel bag, made by rolling coarse flannel round a stout tube or rod and tying up one end, is tied by the other end on to the nozzle of a cylinder of carbon dioxide. When the gas is turned on, a rod of solid carbon dioxide soon forms, and can be easily removed by undoing the bag or cutting it open. D. A. L.

**Action of Hydrogen Peroxide on Carbonates.** By P. KAZAN-EZKY (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 388—391. Compare this vol., ii, 317).—The action of hydrogen peroxide on potassium carbonate yields two compounds having compositions represented by the formulæ  $K_2CO_3 \cdot 2H_2O_2 \cdot \frac{1}{2}H_2O$  and  $K_2CO_3 \cdot 3H_2O_2$ ; the author ascribes to them the constitutions  $(K \cdot O \cdot O \cdot O)_2CO \cdot 2\frac{1}{2}H_2O$ , and  $(K \cdot O \cdot O \cdot O)_2CO \cdot 3H_2O$  respectively. T. H. P.

**Colloidal Silver.** By CARL PAAL (*Ber.*, 1902, 35, 2224—2236).—Colloidal silver is formed whenever a solution of colloidal silver oxide is reduced, for example, by hydrazine hydrate. It is best prepared by adding silver nitrate to an alkaline solution of sodium protalbate or lysalbate (this vol., i, 653), warming the mixture at  $100^\circ$  until the reduction is complete, and then evaporating after removal of the inorganic salts by dialysis. By using large quantities of silver nitrate and sodium lysalbate, a solid product was obtained on acidifying with acetic acid, containing 90 per cent. of colloidal silver. This mixture was soluble in alkalis, but loses this solubility in part on keeping. The solutions of colloidal silver have a characteristic colour, and the solid is grey or black, with a steel blue or greenish-blue lustre. This form of colloidal silver is far more stable than the commercial form (collargol), a solution of which can neither be evaporated nor frozen, without reconversion of silver into the ordinary form. K. J. P. O.

**Colloidal Silver Oxide.** By CARL PAAL (*Ber.*, 1902, 35, 2206—2218).—When aqueous potassium or sodium hydroxide is added to a suspension of silver protalbate or lysalbate (this vol., i, 653), the whole of the solid dissolves. The silver appears to be present as colloidal silver oxide, as not only does the solution show none of the ordinary reactions of silver, but on dialysis the alkali salt of protalbic or lysalbic acid diffuses, but no silver, until ammonia has been added, when the soluble ammoniacal compound of silver oxide diffuses. A very concentrated solution of this colloidal oxide can be prepared by adding silver nitrate to the solution obtained as above, until a precipitate is formed, and then sufficient aqueous potassium hydroxide to again dissolve it. After removing the alkali nitrate by dialysis, a mixture of alkali protalbate and colloidal silver oxide may be obtained by pouring the solution into alcohol or evaporating it at a low temperature. This mixture is pure white when obtained by precipitation, but nearly black when prepared by evaporation. Both specimens retain the faculty of being soluble in water for a very long period. When first prepared, the solutions are colourless, but soon become dark, probably from the conversion of the colloidal silver

hydroxide first formed into the colloidal oxide. Hydrazine hydrate reduces the oxide to colloidal silver. K. J. P. O.

**Combining Weight of Calcium. II.** By F. WILLY HINRICHSSEN (*Zeit. physikal. Chem.*, 1902, 40, 746—749. Compare this vol., ii, 137).—The combining weight of calcium has been determined by the ignition of calcespar from a Russian source, this calcespar containing 0.012 per cent. of silica and 0.054 per cent. of iron. The values obtained for the atomic weight of calcium were 40.139 and 40.136. In the author's method of ignition, care is taken to prevent any loss of the oxide by sublimation, and probably neglect of this precaution is responsible for the low values obtained by previous workers. J. C. P.

**Hydrated Barium Silicate.** By W. WAHL (*Zeit. Kryst. Min.*, 1902, 36, 156—160).—Optical and goniometric measurements were made on crystals formed in a glass bottle in which barium hydroxide had been left for about a dozen years. The crystals are rhombic and reach a length of 7 mm.; sp. gr. 2.585 and 2.604; their composition is  $\text{BaSiO}_3 \cdot 6\text{H}_2\text{O}$ . Water is lost in dry air, and all except 1 molecule is expelled below  $180^\circ$ ; the formula may therefore be written as  $\text{BaH}_2\text{SiO}_4 \cdot 5\text{H}_2\text{O}$ . Small crystals of the same substance, which is analogous to the zeolites, were obtained by the action of barium hydroxide on amorphous silica. L. J. S.

**Preparation of Arsenic-free Zinc.** By OTTO HEHNER (*J. Soc. Chem. Ind.*, 1902, 21, 675—676).—A few pounds of ordinary zinc are melted in a clay crucible over a gas fire and a piece of sodium is added, using for each pound of zinc about 1 gram of sodium at a time. The molten metal is stirred with a piece of hard glass tubing bent at right angles; an iron rod should not be used on any account. After removing the scum with a porcelain spoon, another piece of sodium is introduced and the mass stirred and skimmed as before. Finally, the metal is poured into a second crucible and the treatment with sodium repeated once more. When the mass has considerably cooled, the metal is granulated by pouring into water, best containing a very little acid. L. DE K.

**Action of Solid Substances on one another.** By J. MATUSCHEK (*Chem. Zeit.*, 1902, 26, 526—527).—Zinc nitrite is formed when dry sodium nitrite and zinc chloride or sulphate, with or without water of crystallisation, are shaken together. The heat developed by the reaction decomposes part of the zinc nitrite to zinc oxide with evolution of brown fumes. With magnesium sulphate or barium chloride, the reaction takes place less easily, but more energetically with the chlorides of aluminium, tin, or iron. G. Y.

**Alloys of Cadmium and Magnesium.** By OCTAVE BOUDOUARD (*Compt. rend.*, 1902, 134, 1431—1434. Compare Abstr., 1901, ii, 512).—The melting points of mixtures of cadmium and magnesium, varying in composition from 90 per cent. cadmium to 90 per cent. magnesium, show three maxima ( $500^\circ$ ,  $565^\circ$ , and  $650^\circ$ ) and two

minima ( $400^{\circ}$  and  $560^{\circ}$ ); the three maxima correspond respectively with three compounds,  $\text{CdMg}$ ,  $\text{CdMg}_4$ , and  $\text{CdMg}_{30}$ . The compound  $\text{CdMg}$  was isolated by treating the mixture of 75 parts of cadmium and 25 parts of magnesium with cold aqueous 1 per cent. ammonium chloride, when the alloy is left as a grey, crystalline powder. The compound  $\text{CdMg}_4$  is obtained in a similar manner from the mixture of 53.5 per cent. of cadmium and 46.5 per cent. of magnesium; the third compound was not isolated. By etching the polish surface of mixtures of appropriate composition, crystals of the three compounds just mentioned can be shown to be present. All these alloys are white in colour, are moderately malleable, are permanent in dry air, but are very readily attacked in the presence of water.

K. J. P. O.

**Cuprous Compounds. I.** By GUIDO BODLÄNDER and O. STORBECK (*Zeit. anorg. Chem.*, 1902, 31, 1—41).—An attempt has been made to ascertain the tension required to separate cuprous ions from a normal solution; incidentally, side questions have arisen, such as the degree of dissociation of cuprous salts and the nature of the cuprous ion, ( $\text{Cu}^{\cdot}$  or  $\text{Cu}_2^{\cdot\cdot}$ ). From the solubility of cuprous chloride in water, it is shown that decomposition according to the equation  $2\text{CuCl} \rightleftharpoons \text{CuCl}_2 + \text{Cu}$  (or  $\text{Cu}_2\text{Cl}_2 \rightleftharpoons \text{CuCl}_2 + \text{Cu}$ ) occurs and at the same time hydrolysis takes place. The cuprous copper which is present in the solution does not exist completely as simply cuprous ions, but partly as complex ions formed from chlorine ions and undissociated cuprous chloride as the neutral component. The solubility of cuprous chloride in hydrochloric acid and potassium chloride solutions was also determined. At low concentrations of hydrochloric acid, the quotient  $[\text{Cl}]/[\text{Cu}]$  is nearly constant, therefore at such concentrations the complex ion has probably the composition  $\text{CuCl}_2'$ ; in concentrated solution, the quotient  $[\text{Cl}]^2/[\text{CuCl}_2]$  is constant, and in this case the composition of the complex anion is  $\text{CuCl}_3''$ .

The solubility of cuprous chloride in presence of excess of cupric ions was determined in order to ascertain whether the cuprous ion is  $\text{Cu}^{\cdot}$  or  $\text{Cu}_2^{\cdot\cdot}$ ; on account of the uncertainty of the degree of dissociation of the cupric salt, no definite conclusion could be arrived at.

From the results obtained on the solubility of cuprous chloride on addition of potassium chloride, it is concluded that the compound  $(\text{CuCl})_m \cdot \text{KCl}$  is formed. The *E.M.F.* of concentration cells (see Bodländer, *Festschrift für Richard Dedekind*, Brunswick, 1901) containing potassium chloride was determined, and from the results the formation of  $\text{K}_2\text{CuCl}_3$  is confirmed. In solutions of potassium chloride from 0.1 to 0.22*N* the compound  $\text{KCuCl}_2$  is formed and gives the anion  $\text{CuCl}_2'$ .

J. McC.

**Constitution of Cuprammonium Salts; Action of Ammonia.** By ALBERT BOUZAT (*Compt. rend.*, 1902, 134, 1216—1219).—The quantity of heat developed by the action of an excess of ammonia on a dissolved cupric salt of a strong acid is independent of the nature of the acid and is considerably higher than that calculated on the assumption that simple decomposition takes place. It follows that cuprammonium salts are salts of a complex base, and not ordinary basic salts.

C. H. B.



**Copper Chloro-, Bromo-, and Iodo-bismuthites.** By FERNAND DUCATTE (*Compt. rend.*, 1902, 134, 1212—1213).—The action of halogen salts of copper on bismuth sulphide yields bronze-grey, well-crystallised compounds of the type  $2Cu_2S, Bi_2S_3, 2BiSX$ , where  $X = Cl, Br, \text{ or } I$ . They are stable at the ordinary temperature, but decompose when heated in air, and are attacked by dilute acids with liberation of hydrogen sulphide. The chlorine compound has a sp. gr. 6.78, the bromine compound 6.41, and the iodine compound 6.50.

C. H. B.

**Colloidal Mercuric Oxide.** By CARL PAAL (*Ber.*, 1902, 35, 2219—2223).—When aqueous sodium hydroxide is added to mercuric protalbate or lysalbate, or when mercuric chloride is added to an alkaline solution of the sodium salts of these acids, a solution of colloidal mercuric oxide is obtained, which may be freed from inorganic and some of the organic material by dialysis. The colloidal mercury compound is not dialysable. The solution is yellow in colour and only transparent when in thin layers. On evaporation at a low temperature, a mixture of colloidal mercuric oxide and salts of protalbic or lysalbic acid is formed, which consists of reddish-brown scales and is soluble in water. The solutions of the colloidal oxide are easily reduced, especially under the influence of light, metallic mercury being deposited. With the aid of lysalbic acid, a solid can be obtained containing more than 40 per cent. of colloidal oxide. K. J. P. O.

**Decomposition of Mercury Nitrates by Heating.** By J. MYERS (*Proc. K. Akad. Wetensch. Amsterdam*, 1902, 4, 657—659).—Crystallised mercurous nitrate, when heated, evolves at first a mixture of nitrogen peroxide and nitrogen trioxide, and finally nitric oxide. If the anhydrous salt be used, almost pure nitrogen peroxide is obtained. During the decomposition, a yellow sublimate is formed in the neck of the retort and analysis indicates that this may be a mercurio-mercuric orthonitrate,  $Hg'_2Hg''_2(NO_4)_2$ , derived from orthonitric acid,  $H_3NO_4$ . The same substance is produced by heating mercuric nitrate or by heating mercurous nitrate in a vacuum tube. The author supposes that at the high temperature complex molecules  $Hg_4(NO_3)_4$  or  $Hg_4(NO_3)_8$  suffer decomposition into this mercurio-mercuric orthonitrate with evolution in the former case of  $2NO_2$ , and in the latter of  $6NO_2$  and  $2O_2$ . J. McC.

**Influence of Cerium on Lanthanum containing Didymium and Praseodymium.** By ROBERT MARC (*Ber.*, 1902, 35, 2370—2376).—A sample of ordinary brown didymium oxide, giving none of the ordinary reactions for cerium, was dissolved in hydrochloric acid, the solution being then rendered slightly alkaline and saturated with chlorine. The greater part of the oxide passed into solution, leaving a small, insoluble residue. The soluble and insoluble portions, after being reconverted into oxides, exhibited the same spectral bands and were apparently equally rich in praseodymium. The oxide, obtained from the insoluble residue, had, however, a brown

colour and gave abundant indications of cerium and peroxides; the oxide recovered from the solution, on the other hand, was grey in colour and did not evolve chlorine when treated with hydrochloric acid. On adding 1—2 per cent. of a cerium salt to the solution of the grey oxide and igniting the mixture, a brown product was obtained which resembled the original material in evolving chlorine with hydrochloric acid and giving none of the reactions of cerium.

This separation of didymium from cerium is less easily effected in mixtures of praseodymium, lanthanum and cerium oxides containing only small quantities of neodymium, and it is necessary to repeat the operation four times before a white or pink oxide is obtained which is free from peroxide.

These results indicate that the presence of cerium is necessary for the peroxidation of didymium. Accordingly mixtures containing a definite amount of cerium were prepared by adding varying quantities of cerous salt to the solution of the purified grey didymium oxide, the hydroxides being subsequently precipitated and ignited to oxides. It was found that the amount of peroxide present in the product is rapidly augmented by increasing the percentage of cerium, this element being conveniently estimated by Knorre's method (Abstr., 1900, ii, 576), whilst the peroxide was determined iodometrically after distillation with hydrochloric acid in a current of carbon dioxide. Small quantities of cerium have very little influence on the formation of peroxide, and the action first becomes noteworthy when 2 per cent. of this element is present, the mixture then containing 2.25 per cent. of peroxide. The addition of 5 per cent. of cerium leads to the production of 14.76 per cent. of peroxide; 10 per cent. of this impurity gives rise to 35.89 per cent. of higher oxide, and more than 45.18 per cent. of this product results from the introduction of 15 per cent. of cerium. The specimen of didymium oxide employed contained only about 15 per cent. of praseodymium, so that the final result must be due to the simultaneous peroxidation of the neodymium present. Nevertheless, the addition of cerium to pure neodymium oxide does not induce the formation of peroxide.

A sample of praseodymium prepared by Schottländer gave no spectral bands of neodymium and no indications of cerium; nevertheless, it had a brown colour, and on treatment with hydrochloric acid evolved an amount of chlorine corresponding with 44.12 per cent. of peroxide. It was not found possible to free it from cerium by the above described process, yet the addition of an equal weight of lanthanum oxide entirely prevented the formation of peroxide, whilst half this amount reduced the proportion of higher oxide to 0.50 per cent. Neodymium and lanthanum therefore seem to hinder this peroxidising action of cerium.

Specimens of didymium oxide with 2—10 per cent. of cerium give very faint indications of the latter element when tested with hydrogen peroxide or ammonium persulphate. Since these reactions depend on the conversion of colourless cerous compounds into ceric derivatives, it is extremely probable that the exchange of oxygen between the didymium and cerium oxides occurs even in the hydrated condition and in solutions of their salts.

G. T. M.

**Terbium.** By ROBERT MARC (*Ber.*, 1902, 35, 2382—2390).—An earth obtained in the separation of didymium from monazite by the chromic acid method was freed from neodymium and samarium by precipitating with potassium sulphate, and was then fractionally precipitated with ammonia. During the fractionation, the oxide became darker and finally deep ochre-brown; the erbium absorption spectrum became feebler and finally disappeared, leaving a new band,  $\lambda$  644—641, together with Soret's four holmium-bands,  $\lambda$  454—449, 640, 536, and 522. The atomic weight of the fraction (reckoned on  $R_2O_3$ ) was 158. This could not be altered by fractionation with ammonia, but a further separation was effected by means of the oxalates, the atomic weight ranging from 151.95 to 161.18. The brown colour of the oxide was unaffected by the oxalate fractionation; it is removed by igniting in a stream of hydrogen with loss in weight of 0.069 per cent., whilst a determination by titration of the active oxygen in the same sample gave  $O = 0.075$  per cent.; this would correspond with the presence of about 1.5 per cent. of peroxide-forming earth.

The conclusions drawn are (1) that terbium oxide has an intense ochre-brown colour, (2) that the earths described as terbia have usually been mixtures of yttria with a heavier, colourless, spectrum-free earth, probably ytterbium, and containing only a small amount of terbium oxide, (3) that terbium forms two oxides, of which the higher is coloured (compare praseodymium), and (4) that terbium has a characteristic absorption spectrum, the chief feature of which is the band  $\lambda$  464—461.

T. M. L.

**Preparation of Anhydrous Chlorides of Samarium, Yttrium, and Ytterbium.** By CAMILLE MATIGNON (*Compt. rend.*, 1902, 134, 1308—1310).—Hydrated samarium chloride,  $SmCl_3 \cdot 6H_2O$ , when heated at  $100^\circ$  in a current of dry hydrogen chloride, loses 5 mols. of water, and the sixth mol. after prolonged heating at  $180^\circ$ . The anhydrous salt fuses below  $1000^\circ$  to a brownish liquid. It is easily soluble in water and is very hygroscopic.

Hydrated yttrium chloride,  $YCl_3 \cdot 6H_2O$ , and ytterbium chloride,  $YbCl_3 \cdot 6H_2O$ , both act on polarised light; the former fuses at  $163^\circ$ , the latter at  $150$ — $155^\circ$ . When heated in a current of dry hydrogen chloride, they behave exactly as samarium chloride does, giving in the first place monohydrates, then the anhydrous salts. J. McC.

**Compounds of Anhydrous Aluminium Chloride with Hydrogen Sulphide.** By E. BAUD (*Compt. rend.*, 1902, 134, 1429—1431).—When dry aluminium chloride is heated in a current of dry hydrogen sulphide, a crystalline sublimate is formed which consists of aluminium chloride containing a variable quantity of hydrogen sulphide. At the ordinary temperature, hydrogen sulphide is also absorbed to a certain extent. If the chloride is treated with liquid hydrogen sulphide at  $-70^\circ$  and the liquid allowed to evaporate, a white solid is left which, as the temperature rises from  $-45^\circ$  to the ordinary temperature, gives off 1 mol. of hydrogen sulphide for each mol. of aluminium chloride used. The solid remaining still contains hydrogen sulphide and is a compound,  $Al_2Cl_6 \cdot H_2S$ , which is stable at the ordinary tem-

perature; its dissociation pressure is 760 mm. at about 60°. It is decomposed by water, and its heat of dissolution is +150.56 Cal., therefore the heat of formation of solid  $\text{Al}_2\text{Cl}_6\cdot\text{H}_2\text{S}$  is +9.45 Cal., whereas that calculated by means of Trouton's formula from the dissociation pressure is 9.99 Cal.

K. J. P. O.

**Fluoromolybdates.** By P. KAZANEZKY (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 383—387).—By the action of hydrogen peroxide on the double salt of potassium fluoride with potassium fluoropermolybdate having the composition  $\text{MoO}_2\text{F}_2\cdot 2\text{KF}\cdot\text{H}_2\text{O}$ , the two fluorine atoms of the fluoropermolybdate molecule are first replaced by the peroxide residue,  $-\text{O}\cdot\text{O}-$ , giving a compound of the formula  $\text{MoO}_4\cdot 2\text{KF}\cdot\text{H}_2\text{O}$ . Continued action of the hydrogen peroxide results in the formation of a substance approximating in composition to that of potassium permolybdate.

T. H. P.

**Atomic Weight of Uranium.** By THEODORE W. RICHARDS and BENJAMIN S. MERIGOLD (*Chem. News*, 1902, 85, 177—178, 186—188, 201, 207—209, 222—224, 229—230, 249).—Uranous bromide was prepared by heating urano-uranic oxide in an atmosphere of bromine, the bromide being sublimed, transferred to a weighing bottle, and the bottle stoppered, in a specially devised apparatus which is described, and which permitted all these operations to be performed in an atmosphere of either nitrogen or bromine with the rigorous exclusion of oxygen and hydrogen. The bottle of uranous bromide, after weighing, was opened under water, dilute hydrogen peroxide was added, and the bromine was precipitated in one series by means of excess of silver nitrate, and in another by the addition of the exact weight of silver dissolved in nitric acid. From the first series, the mean number 238.54, from the second series, 238.52, was obtained for the atomic weight of uranium, the molecular weight of silver bromide being taken as 187.885. A correction is made for the amount of sodium bromide in the uranous bromide. The extreme numbers in the authors' final six analyses are  $\text{U} = 238.46$  and  $238.60$ , the mean being 238.53 ( $\text{O} = 16$ ;  $\text{Br} = 79.955$ ).

D. A. L.

**Octa-hydrated Uranium Sulphate.** By N. A. ORLOFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 381—383).—This salt,  $\text{U}(\text{SO}_4)_3\cdot\text{H}_2\text{O}$ , can be obtained in well-developed crystals by the action of sunlight on a solution of  $\text{UO}_2\text{SO}_4$  in alcohol.

T. H. P.

**Characteristics of Compounds of Quadrivalent Uranium.** By N. A. ORLOFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 375—380).—The author has obtained well-crystallised uranium compounds of the following compositions:  $\text{U}(\text{C}_2\text{O}_4)_2\cdot 6\text{H}_2\text{O}$ ;  $2\text{U}(\text{C}_2\text{O}_4)_2\cdot \text{K}_2\text{C}_2\text{O}_4\cdot 8\frac{1}{2}\text{H}_2\text{O}$ ; and  $\text{UCl}_4\cdot \text{UO}_2\cdot 2\text{NaCl}\cdot 6\text{H}_2\text{O}$ .

T. H. P.

**Ammonium Vanadicophosphotungstate.** By EDGAR F. SMITH and FRANZ F. EXNER (*J. Amer. Chem. Soc.*, 1902, 24, 573—578).—During the investigation of a large quantity of wolframite, it was observed that the mother liquors from the ammonium paratungstate had



a dark colour. This colour was found to be due to the presence of *ammonium vanadichosphotungstate*,  $(\text{NH}_4)_2\text{O} \cdot \text{V}_2\text{O}_5 \cdot \text{P}_2\text{O}_5 \cdot \text{WO}_3 \cdot x\text{H}_2\text{O}$ , which forms large, brilliant, black, octahedral crystals. E. G.

**Preparation of Antimony Hydride.** By ALFRED STOCK and WALTHER DÖHT (*Ber.*, 1902, 35, 2270—2275).—Alloys of antimony and zinc give a very poor yield of the hydride; a gas containing 0.71 per cent. of the hydride by volume can be obtained by the action of 12 per cent. hydrochloric acid on an alloy containing 40 per cent. of antimony, and a gas containing 0.96 per cent. of antimony hydride by the action of dilute sulphuric acid on a 25 per cent. alloy. The sodium alloys give even smaller yields. Antimony-calcium alloys, when decomposed with dilute hydrochloric acid in a freezing mixture, give a gas containing up to 16.3 per cent. of the hydride, but the total yield of gas is small. The best results are obtained with alloys of antimony and magnesium; an alloy containing 33 per cent. of antimony decomposed with 12 per cent. hydrochloric acid in a freezing mixture gives a gas containing 10.4—14.0 per cent. of antimony hydride. The remainder of the gas, if carefully dried, consists of pure hydrogen, and on cooling with liquid air, the antimony hydride separates in a pure condition. It melts at  $-88^\circ$  to a water-white liquid, boils at  $-17^\circ$  under 760 mm. pressure, leaving no residue, and gives a gas consisting entirely of the hydride  $\text{SbH}_3$ . In a pure state, the gas only begins to deposit antimony after some hours at the atmospheric temperature, but rapidly decomposes above  $150^\circ$ . Olszewski (*Abstr.*, 1886, 977), who states that the gas begins to decompose at  $-60^\circ$ , was probably dealing with an impure or moist gas. T. M. L.

**Kermes Mineral.** By KARL FEIST (*Arch. Pharm.*, 1902, 240, 241—244).—The crystalline constituent of kermes mineral, hitherto regarded as antimony oxide, is shown to be sodium pyroantimonate,  $\text{Na}_2\text{H}_2\text{Sb}_2\text{O}_7 \cdot 6\text{H}_2\text{O}$ . It is present when the kermes is prepared by boiling antimony sulphide with 10 per cent. aqueous sodium carbonate, the air having access; in the absence of air, the preparation has no crystalline constituent. The analogous potassium compound is much more soluble, and does not crystallise so easily; in consequence, kermes mineral, prepared by means of potassium, instead of sodium, carbonate, contains little or no antimonate. C. F. B.

**Isomorphism of Salts of Bismuth and some of the Rare Earths.** By GÖSTE BODMAN (*Zeit. Kryst. Min.*, 1902, 36, 192—193; from *Bihang K. Svenska Vet. Akad. Handl.*, 1900, 26, II, No. 3. Compare *Abstr.*, 1898, ii, 435).—Mixed crystals of didymium and bismuth nitrate belong to two types. Those of one series are of a deep red colour with  $\text{Di}:\text{Bi}=4:1$  to  $1:1$ , and the formula  $(\text{Di,Bi})(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$ ; sp. gr. = 2.296—2.480. Those of the other series are of a faint amethyst-red, with  $\text{Di}:\text{Bi}$  less than  $1:4$ , and only  $5\text{H}_2\text{O}$ ; sp. gr. = 2.700—2.813.

Mixed crystals of bismuth and lanthanum also belong to two types. In one series, with  $\text{Bi}:\text{La}=55:1$  to  $12.6:1$ , the sp. gr. and the amount of water are the same as in bismuth nitrate; another mixture, with

La : Bi = 67 : 1, has  $6\text{H}_2\text{O}$  and sp. gr. = 2.367. Crystals of bismuth and yttrium nitrate are also of two types, with sp. gr. = 2.816—2.653 and 2.286—2.152.

Only sulphates containing small amounts of bismuth were obtained, as given below :

	Di : Bi.	Sp. gr.
$(\text{Di}, \text{Bi})_2(\text{SO}_4)_3, 8\text{H}_2\text{O}$ .....	2—49 : 1	2.85—3.067
$(\text{La}, \text{Bi})_2(\text{SO}_4)_3, 9\text{H}_2\text{O}$ .....	7.4—149 : 1	2.870—2.847
$(\text{La}, \text{Bi})_2(\text{SO}_4)_3, 5\text{H}_2\text{O}$ .....	9.37—210 : 1	3.148—3.105
$(\text{Y}, \text{Bi})_2(\text{SO}_4)_3, 8\text{H}_2\text{O}$ .....	6.15—139 : 1	2.551—2.651

L. J. S.

**Radioactive Bismuth-Polonium.** By WILHELM MARCKWALD (*Ber.*, 1902, 35, 2285—2288).—The presence of some new element, polonium, in ordinary radioactive bismuth, has been established. When a solution of the chloride is electrolysed, the metal which is first deposited is much more radioactive than the original substance, and even when a polished rod of bismuth is placed in a solution of the chloride a small, extremely active, metallic deposit is formed on the surface of the bismuth, owing to the difference in potential between the new element and metallic bismuth. After three days, the whole of the active element has become deposited, and the solution shows no radioactivity. The deposit contains small amounts of chloride, which can be removed by sublimation ; the metallic bead thus obtained dissolves in nitric acid, and the solution exhibits most of the reactions characteristic of bismuth ions. The active rays emitted by the metal and its solutions differ from radium rays, as they are incapable of passing through paper and other obstacles. The author hopes to obtain sufficient of the new metal to determine its atomic weight. The activity of the specimens of polonium does not diminish even after several months.

J. J. S.

**Colloidal Gold.** By CARL PAAL (*Ber.*, 1902, 35, 2236—2244).—On mixing an alkaline solution of protalbic or lysalbic acid and a solution of gold chloride, a clear, pale yellow solution is obtained, which contains gold in the ordinary condition, as it can be dialysed and gives the ordinary reactions. On warming this solution or treating it with formaldehyde, &c., it becomes ruby-red in colour, and now contains colloidal gold, which is no longer capable of passing through a dialyser. When the solution is poured into alcohol or cautiously acidified, a coloured solid is thrown down which may contain 90 per cent. of colloidal gold. This solid is soluble in dilute alkali, is of metallic appearance, resembling iron pyrites, and has a high specific gravity.

K. J. P. O.

## Mineralogical Chemistry.

**Composition of Silver Amalgam from Sala.** By HJALMAR SJÖGREN (*Zeit. Kryst. Min.*, 1902, 36, 192; from *Geol. För. Förh.*, 1900, 22, 187—190).—Two varieties of silver amalgam occur at Sala in Sweden, of which the following analyses by R. Manzelius are given. I, Crystals the size of a pea or bean rich in faces are found in cavities filled with mercury. The mineral is of a brilliant silver-white colour; it is brittle and has a conchoidal fracture. II, Impure massive material filling crevices; this tarnishes yellow, has a hackly fracture, and is only slightly brittle:

	Ag.	Hg.	Cu.	Zn.	Fe.	S.	Insol. (silicate)	Total.	Sp. gr.	Formula.
I.	26·48	73·44	—	—	—	—	—	99·92	13·71	Ag <sub>2</sub> Hg <sub>3</sub>
II.	27·25	63·86	1·38	1·37	1·97	[3·21]	0·96	100·00	11·56	Ag <sub>5</sub> Hg <sub>6</sub>

L. J. S.

**Ferghana Naphtha.** By K. CHARITSCHKOFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 395—397).—The author has examined naphtha from Liakan in the Province of Ferghana. It yields about 23·8 per cent. of kerosine, 2·6 of paraffin, and practically no 'benzine'; the percentage of sulphur is 0·57.

T. H. P.

**Discovery of Gold Tellurides in Western Australia.** By ARTHUR G. HOLROYD (*Trans. Australian Inst. Mining Eng.*, 1897, 4, 186—193).—The important discovery of tellurides of gold at Kalgoorlie in the East Coolgardie gold-field was announced by the author in *The Kalgoorlie Miner* of May 29th, 1896. The mineral species recognised are calaverite and sylvanite; native tellurium is also recorded. Analyses of the calaverite gave:

Au.	Ag.	Te.
44	traces	55
39·2	3	54

The gold set free by the oxidation of the tellurides is amorphous ("mustard-gold") or finely crystallised ("sponge-gold").

L. J. S.

[Calaverite and Coloradoite from Western Australia.] By EDWARD S. SIMPSON (*Ann. Prog. Rep. Geol. Survey, Western Australia* for 1897, 1898, 46—50).—Calaverite from several mines at Boulder [Kalgoorlie] is massive and has a pale brass-yellow colour. Some specimens are described as having a perfect cleavage in one direction [these are probably sylvanite.—L. J. S.], whilst others have an uneven to sub-conchoidal fracture. Analyses (II by G. J. Rogers) gave results agreeing with the formula AuTe<sub>2</sub>. Other specimens contained 41·28 and 37·10 per cent. of gold:

	Te.	Au.	Ag.	S.	Cu.	Fe.	Pb, Bi, Zn.	Total.	Sp. gr.
I.	57·27	41·37	0·58	—	—	—	—	99·22	9·311
II.	59·69	38·70	1·66	0·09	0·21	0·18	traces	100·53	—

The telluride of mercury, coloradoite, is recorded from this locality.

It is massive with a conchoidal fracture, dark lead-grey colour and brilliant metallic lustre; sp. gr. 9.21. It is associated with free gold, cinnabar, calaverite and small rhombic crystals of another telluride of gold, perhaps krennerite.

L. J. S.

[Coloradoite from Western Australia.] By EDWARD S. SIMPSON (*Ann. Prog. Rep. Geol. Survey, Western Australia* for 1898, 1899, 57—59).—Analysis of material from Boulder similar to that before described (compare preceding abstract) gave:

Hg.	Ag.	Au.	Te.	Total.
50.40	0.12	trace	[49.48]	100.00

From these results, the formula  $\text{Hg}_2\text{Te}_3$  is deduced. The formula at present accepted for this mineral, namely,  $\text{HgTe}$ , is based on Gentl's analyses of material from Colorado which showed 2.9—46.8 per cent. of impurities; it is pointed out that the mean of these analyses agrees better with the new formula than with the old.

L. J. S.

Zincite from Poland. By J. A. ANTIPOFF (*Zeit. Kryst. Min.*, 1902, 36, 176; from *Verh. k. russ. min. Ges.*, 1900, 38, prot. 41—42).—A mineral, thought to be calamine, from the Olkuschsk mine is shown by the following analysis and the crystalline form to be zincite, a mineral now recognised for the first time as occurring in Russia:

ZnO.	PbO.	CO <sub>2</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	Insol.	Organic matter.	Total.
91.47	5.26	2.85	0.11	0.12	trace	99.81.

This corresponds with ZnO, 88.25;  $\text{PbCO}_3$ , 6.41;  $\text{ZnCO}_3$ , 5.03 per cent.

L. J. S.

A Uranium Mineral Resembling Voglite. By J. A. ANTIPOFF (*Zeit. Kryst. Min.*, 1902, 36, 175; from *Verh. K. russ. min. Ges.*, 1900, 38, prot. 38—41).—The mineral is found as fine scales on, and embedded in, calcite at the Utsch-Kirtan pass, 120 kilometres from Margelan in Gov. Ferghana. It appears to be isotropic; sp. gr. 3.35. Analysis of isolated scales gave the results under I; neglecting iron and calcium, this gives the formula  $(\text{CO}_3)_2(\text{UO}_2)\text{Cu}, 10\text{H}_2\text{O}$ , near to that of the Bohemian voglite. Analysis of the calcite with the enclosed mineral gave II; here the ratio of  $\text{U}_2\text{O}_3:\text{CuO}$  is different from that in analysis I:

	H <sub>2</sub> O.	CO <sub>2</sub> .	U <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	CuO.	CaO.	P <sub>2</sub> O <sub>5</sub> .	SiO <sub>2</sub> .	Total.
I.	42.13	10.88	35.45	1.12	9.71	1.35	trace	—	100.64
II.	4.83	32.35	11.72	4.22	3.41	40.12	0.54	3.18	100.37
III.	—	—	78.25	12.09	8.41	—	—	—	98.75

When the mineral is treated with hydrochloric acid, small, yellowish-green scales remain; this insoluble residue has the composition given under III, corresponding with the formula  $\text{U}_2\text{O}_3, \text{CuO}$ . Such a compound has not before been observed in nature, but has been prepared by Debray.

L. J. S.

Separation of Glauber Salt [Mirabilite] in the Kara-bugas. By NICOLAI S. KURNAKOFF (*Zeit. Kryst. Min.*, 1902, 36, 174—175; from *Verh. K. russ. min. Ges.*, 1900, 38, prot. 26—27. Compare Abstr.,



1899, ii, 303).—The solubility relations of glauber salt ( $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ ) are as follows. In pure water, 5.02 per cent. at  $0^\circ$  and 16.8 per cent. at  $17.9^\circ$ ; in water containing 10 parts of sodium chloride, 4 per cent. at  $0^\circ$  and 14 per cent. at  $17.9^\circ$ . A saturated solution of sodium chloride and glauber salt contains:

	$\text{Na}_2\text{SO}_4$ .	$\text{NaCl}$ .
At $0^\circ$ .....	1.77	32.85 per cent.
„ $17.9^\circ$ .....	11.10	33.22 „

Analysis of the water of the Kara-bugas Gulf of the Caspian Sea gave:

$\text{NaCl}$ .	$\text{Na}_2\text{SO}_4$ .	$\text{MgCl}_2$ .	$\text{CaSO}_4$ .
10.55	4.80	5.30	0.45

On comparing these results with the solubilities given above, it will be seen that in summer, when the mean temperature is  $18$ – $20^\circ$ , the water is not saturated with salts, but that in winter (mean temp.  $3$ – $5^\circ$ ) glauber salt will separate. At no time of the year is the water saturated with sodium chloride, so that the glauber salt separates out alone.

L. J. S.

Scheelite from Maderanerthal, Switzerland. By CARL SCHMIDT (*Zeit. Kryst. Min.*, 1902, 36, 160–161).—The second crystal of scheelite that has been found in the Maderanerthal is described. It is an isolated, colourless, and transparent crystal measuring 3.5 cm. in length. The angle  $(111):(11\bar{1})$  is  $49^\circ 27'$ . Analysis by Hinden gave:

$\text{CaO}$ .	$\text{MoO}_3$ .	$\text{WO}_3$ .	Total.
19.45	0.49	79.53	99.47

No connection can be traced between the small variations in the angles of scheelite and the amount of molybdenum present.

L. J. S.

Hydrated Aluminium Silicates. By KONSTANTIN D. GLINKA (*Zeit. Kryst. Min.*, 1902, 36, 188–189; from *Verh. russ. min. Ges.*, 1900, 37, 311–332. Compare Abstr., 1900, ii, 89).—The precipitate obtained when halloysite or kaolin is treated with potassium hydroxide and the solution neutralised with hydrochloric acid has the composition  $\text{K}_2\text{Al}_2\text{Si}_2\text{O}_8 \cdot 2\frac{1}{2}\text{H}_2\text{O}$ . A precipitate having the same composition is also obtained when gibbsite is treated with potassium hydroxide, mixed with a solution of silica in potassium hydroxide, and the mixture acidified.

L. J. S.

Analcite in Liassic Clay from Lehre. By JOHANNES FROMME (*Jahresber. Ver. Naturwiss. Braunschweig*, 1902, 13, 5 pp.).—Small crystals of analcite with the forms  $n\{211\}$  and  $a\{100\}$  occur, together with blende, marcasite, dolomite, calcite, barytes and gypsum, in geodes in Liassic clay at Lehre, near Brunswick. The minerals have been formed in the order just named, and the sulphates have been derived by the oxidation of the sulphides. Analysis I is of crystals of analcite isolated from the carbonates by the action of a 10 per cent. solution of hydrochloric acid; by the action of the acid, the crystals have been decomposed on the surface and coated with a film of silica, and this partly explains the excess of silica shown in the analysis.

Other crystals not treated in this manner gave the partial results under II; the excess of silica is here due to quartz grains enclosed in the crystals, which remain as a gritty residue when the crystals are decomposed by a 38 per cent. solution of hydrochloric acid.

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	CaO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Total.
I.	58.59	20.61	0.48	0.40	0.04	0.98	11.02	8.26	100.38
II.	57.20	21.71	—	—	—	—	—	—	—
III.	54.35	21.92	0.57	1.42	—	0.28	12.54	9.17	100.25

Analysis III (by Ohlmer) is of analcite from Frombach. L. J. S.

**Ilvaite from Siorarsuit, Greenland.** By O. B. BÖGGILD (*Meddelelser om Grönland*, 1902, 25, 43—89).—A crystallographic description, illustrated with thirty-two figures, is given of the brilliant black crystals of ilvaite which occur somewhat abundantly in augite-syenite, sodalite-syenite, and foyaite at Siorarsuit, near Julianehaab, in South Greenland. The natural and artificially produced etch-figures conform with orthorhombic symmetry. The strong pleochroism may even be observed in the light reflected from the surface of the crystals. Sp. gr. 4.0065. Analysis by C. Christensen gave the following results, agreeing with the usual formula,  $\text{HCaFe}''_2\text{Fe}'''\text{Si}_2\text{O}_9$ .

SiO <sub>2</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	MnO.	CaO.	H <sub>2</sub> O.	Total.
29.62	19.48	33.28	2.20	14.38	2.24	101.20

The following table compares the variation in the axial ratios with the amount of manganese present:

	MnO per cent.	$a:b:c$ .
Elba .....	0.74—1.55	0.6665:1:0.4427
Kangerdluarsuk.....	1.97	0.6744:1:0.4484
Siorarsuit .....	2.20	0.6766:1:0.4499
Herbornseelbach .....	6.78—8.68	0.6795:1:0.4576

L. J. S.

**Brunsvigite, a new Leptochlorite from the Radauthal.** By JOHANNES FROMME (*Tsch. Min. Mitth.*, 1902, 21, 171—177).—A chloritic mineral of wide distribution in the gabbro of the Radauthal, Harz, is described under the new name *brunsvigite*. It occurs as cryptocrystalline and fine scaly masses in veins of quartz, calcite and various mineral sulphides, in which it fills crevices or forms small, radially fibrous aggregates. It is green to dark leek-green, and optically uniaxial and negative; the hexagonal scales have a perfect cleavage parallel to the basal plane. Sp. gr. = 3.01. The following analysis gives the formula  $6\text{SiO}_2, 2\text{Al}_2\text{O}_3, 6\text{FeO}, 3\text{MgO}, 8\text{H}_2\text{O}$ , which is written, in accordance with Tschermak's theory of the chlorites, as  $\text{Sp}_5\text{At}_3\text{At}'_2$ , or  $5(\text{Si}_2\text{Mg}_3\text{H}_4\text{O}_9), 3(\text{SiAl}_2\text{Mg}_2\text{H}_4\text{O}_9), 2(\text{SiAl}_2\text{MgH}_4\text{O}_8)$ . The mineral is most closely related to metachlorite, which it closely resembles in appearance and sp. gr.

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	MnO.	CaO.	MgO.	H <sub>2</sub> O.	Moisture.	Total.
27.88	15.81	1.77	31.92	0.51	0.20	9.52	11.97	0.15	99.73

L. J. S.

**Composition of Water in Salt-lakes in the Crimea.** By NICOLAI S. KURNAKOFF (*Zeit. Kryst. Min.*, 1902, 36, 174; from *Verh. K. russ. min. Ges.*, 1900, 38, prot. 24—26).—The author has previously shown that the ratio of  $\text{MgSO}_4 : \text{MgCl}_2$  in the waters of many marine salt-lakes in the Crimea is always 0.5—0.7. In salt-lakes which receive part of their water from continental areas, this ratio is less, and in typical continental salt-lakes it is very nearly zero. Analyses of the water of different salt-lakes of the Perekop group gave the percentages under I—III. Water (anal. IV) from the Genitschesk salt-lake, which is situated near the sea, is also of the same character, and is therefore largely collected from a continental area :

	$\text{CaSO}_4$ .	$\text{CaCl}_2$ .	$\text{MgSO}_4$ .	$\text{MgCl}_2$ .	$\text{NaCl}$ .	$\text{MgSO}_4 : \text{MgCl}_2$ .
I.	0.05	1.98	—	18.27	8.01 per cent.	0
II.	0.05	—	1.95	7.33	24.33 „	0.266
III.	0.13	1.39	—	10.26	12.80 „	0
IV.	0.05	—	3.21	9.21	14.34 „	0.349

L. J. S.

**Volcanic Dust which fell on Barbados after the St. Vincent Eruption.** By JOHN SMITH FLETT (*Abstr. Proc. Geol. Soc.*, 1902, 117).—The dust which fell on Barbados on May 7th, 1902, after the volcanic eruption at St. Vincent, is a fine, grey, gritty powder, all of which passes through a sieve with 30 meshes to the inch. It contains plagioclase-felspar (generally idiomorphic labradorite) coated with a thin film of glass, hypersthene, brownish monoclinic augite, both frequently in perfect crystals, magnetite, apatite, possibly zircon, and fragments of a brown glass. Analysis by W. Pollard gave :

$\text{SiO}_2$ .	$\text{TiO}_2$ .	$\text{Al}_2\text{O}_3$ .	$\text{Fe}_2\text{O}_3$ .	$\text{FeO}$ .	$\text{MnO}$ .	$(\text{CoNi})\text{O}$ .	$\text{CaO}$ .
52.81	0.95	18.79	3.28	4.58	0.28	0.07	9.58
$\text{MgO}$ .	$\text{K}_2\text{O}$ .	$\text{Na}_2\text{O}$ .	$\text{P}_2\text{O}_5$ .	$\text{SO}_3$ .	$\text{Cl}$ .	$\text{H}_2\text{O}$ .	Total.
5.19	0.60	3.23	0.15	0.33	0.14	0.37	100.35

L. J. S.

## Physiological Chemistry.

**Metabolism and Diet.** By FRANCIS W. GOODBODY, NOEL D. BARDSWELL, and J. E. CHAPMAN (*J. Physiol.*, 1902, 28, 257—273).—Forced feeding in the healthy subject causes marked deterioration in health, and the bad effects last a long time. There is a marked increase in the total urinary nitrogen, but the proportion of urea remains normal. The amount of nitrogen retained is small, but the inorganic constituents of the urine increase. In the faeces, the amount of fat is increased, but not the nitrogen.

W. D. H.

**Metabolism in Men with Special Reference to Proteid Requirements.** By V. O. SIVÉN (*Bied. Centr.*, 1902, 31, 351—352; from *Scand. Arch. Physiol.*, 11, 308).—In an experiment made by the author on himself in which the amount of nitrogen consumed,

commencing with a normal diet, was reduced as much as possible while maintaining equilibrium, a minimum, of 4 grams was reached with food equivalent to 2747 Cal. (43 Cal. per kilo.). The experiment is not quite conclusive, as it lasted only four days, but the limit as indicated is probably approximately correct.

On increasing the amount of nitrogen to 22.6 grams, it was only during the first day or two that any considerable portion of it was retained.

Determinations of sulphur and phosphorus in the food and excrement showed that the changes in these substances follow those of nitrogen.

N. H. J. M.

**Rôle of Crude Fibre in the Nitrogenous Metabolism of the Animal Organism.** By W. USTJANTZEW (*Landw. Versuchs-Stat.*, 1902, 56, 463—475).—Two sheep were fed for three periods of 6 or 7 days with (1) 400 grams of beans, (2) 354 grams of beans and 310 grams of hay, and (3) 300 grams of beans and 353 grams of hay. The nitrogen digested was about the same in each case (16.04, 16.93, and 15.73 grams), whilst the amounts of digested crude fibre and non-nitrogenous extract were 24.14, 87.39, and 132.74 grams, and 163.54, 224.54, and 259.09 grams respectively. The nitrogen in the urine amounted, in the three periods, to 16.51, 15.60, and 12.88 grams per head per day.

The experiment was then continued for two further periods, in which the sheep received (4) 380 grams of beans and 140 grams of rice and (5) 400 grams of beans and 100 grams of sugar. The amount of nitrogen digested again remained the same, whilst the amount of crude fibre digested was about the same as in the first period. As regards non-nitrogenous extract, the amounts digested in periods (4) and (5) were about the same as in (3). The amount of nitrogen in the urine in (4) and (5) was lower than in (1) but higher than in (3).

Experiments made with a rabbit are also described. Whilst starch and sugar effect an economy of proteids in the animal organism, crude fibre possesses this power in a very limited degree.

N. H. J. M.

**Physiological Value of Meat.** By JOHANNES FRENZEL and M. SCHREUER (*Bied. Centr.*, 1902, 31, 391—394; from *Arch. Anat. Physiol.*, 1901, 284—298 and 499—512).—The experiment was made with a dog fed with 470 grams of chopped beef and 130 grams of meat meal (free from fat) per day and lasted five days. Before the commencement of the experiment, the bladder was emptied and carefully rinsed out with 3 per cent. boric acid solution. The following results were obtained.

1 gram of beef, free from fat and mineral matter, = 5629.25 cal., 1 gram of nitrogen in urine and in faeces (free from fat) = 7.31, and 48.24 Cal. respectively. Value for 1 gram of nitrogen in meat meal = 25.62 Cal. Physiological value of the meat and meat-meal diet = 74.84 per cent.

N. H. J. M.

**Physiological Value of Meat Extract.** By JOHANNES FRENZEL and N. TORIYAMA (*Bied. Centr.*, 1902, 31, 391—395; from *Arch. Anat. Physiol.*, 1901, 284—289 and 491—512).—The experiment was similar



to that of Frenzel and Schreuer (preceding abstract). In the preliminary period, the dog received potato starch (100 grams), lard (50 grams), and meat ash (3 grams) per day. In the experimental period, 500 c.c. of a solution of meat extract was given each day in two portions. During this period, the dog received 815.05 Cal., and during the four days' experiment 3260.20 Cal. per day.

Comparing the results of the experimental period with those obtained in the preliminary period, it is found that addition of meat extract to the food resulted in an increased separation of nitrogen in urine and faeces and an increase in the heat values of the excrementitious matters. The conclusion is drawn, in agreement with Pflüger but in opposition to Rubner, that the non-proteid extract of meat has a very considerable share (about two-thirds) in the metabolism.

N. H. J. M.

**The End Products of Gastric Digestion. II.** By LEO LANGSTEIN (*Beitr. chem. Physiol. Path.*, 1902, 2, 229—237).—After gastric digestion had been allowed to go on for three months on crystallised egg-albumin, saturation with ammonium sulphate gave no precipitate, but the biuret reaction was still given. The difference between peptic and tryptic digestion is regarded as mainly quantitative; the persistence of the biuret reaction is one important difference; the absence of histidine and arginine among the products is another. The substances isolated were leucine, tyrosine, glutamic and aspartic acids, cystin, lysine (in small amount), pentamethylenediamine, hydroxyphenylethylamine, and "a polymeric carbohydrate containing nitrogen." Further, a base yielding scatole and two acids of uncertain nature were found. These acids differ by their solubilities in alcohol; they give the biuret reaction, but no other proteid reactions.

W. D. H.

**Synthetic Action on Dextrose with Pancreatic Ferment.** By A. CROFT HILL (*Proc. Physiol. Soc.*, 1902; *J. Physiol.*, 28, xxvi—xxvii).—The reversible action previously described with other diastatic ferments also occurs with pancreatic ferment. The importance of such observations in explaining intracellular syntheses in plants and animals is pointed out.

W. D. H.

**Human Intestinal Juice.** By HARTOG J. HAMBURGER and E. HEKMA (*Proc. K. Akad. Wetensch. Amsterdam*, 1902, 4, 733—746).—The observers had the unusual opportunity of examining human succus entericus. For surgical reasons, it became necessary to isolate a loop of the small intestine, and this loop continued to discharge intestinal juice to the exterior for some time after the operation. This juice, like that of the dog, contains a substance which renders pancreatic juice active. It does not exercise any energising influence on the fat-splitting and amylolytic ferments of the pancreas, but its action on the tryptic ferment is most marked. Quantitative experiments do not bear out Pawloff's view that the active substance in the intestinal juice is a ferment, for it is not able, like a ferment, to act on an unlimited amount of pancreatic juice. The name *zymolysin* is suggested as more appropriate than enterokinase, because its action

appears to be that of liberating the enzyme (trypsin) from its zymogen (trypsinogen).

Some experiments regarding the rate of secretion of the juice are recorded, but although work in this direction is necessarily incomplete, the results obtained show that as in the case of the other digestive juices, the amount is proportional to the necessities of the digestive process.

Cohnheim's erepsin is also present in the human juice; it is not identical with zymolysin, because erepsin is destroyed by heating the juice to 59° for three hours; zymolysin is not destroyed until the temperature is raised to 67°.

W. D. H.

**Absorption of Simple Stereoisomeric Sugars in the Small Intestine.** By JUNZO NAGANO (*Pflüger's Archiv*, 1902, 90, 389—404).—The experiments were made on dogs with a Vella's fistula. The amount of stereoisomeric sugars absorbed is different. Typical results are given in the following table:

Sugar.	Strength of solution.	Amount absorbed.
<i>d</i> -Galactose .....	5 per cent.	all
	7.5 „	83 per cent.
Dextrose .....	5 „	all
	6 „	75 „
	7.5 „	69 „
<i>d</i> -Mannose .....	1 „	all
	2.5 „	71 „
	5 „	56—59 „
<i>d</i> -Fructose .....	2.5 „	all
	5 „	88 „
	7.5 „	60 „

Pentoses are less absorbed than hexoses, and show also individual differences. In the upper part of the intestine, sugar is absorbed more rapidly than water; in the lower part, it is the reverse. W. D. H.

**The Formation of isoValeraldehyde and Acetone from Gelatin.** By CARL NEUBERG and FERDINAND BLUMENTHAL (*Beitr., chem. Physiol. Path.*, 1902, 2, 238—250).—The origin of acetone in the body is a moot point. Whether it always has the same origin is doubtful. The views that it comes from fat, from carbohydrate, or from intestinal putrefaction of proteids are discussed and largely dismissed. The view considered to be most tenable is that it originates by the oxidation of proteid material. The present experiments with gelatin show that acetone is formed as a result of oxidation in the laboratory. Another volatile substance separated out was isovaleraldehyde. The possible way in which such substances might originate is discussed.

W. D. H.

**Ammonia in the Blood and Organs of the Dog.** By W. HORODYŃSKI, SERGEI SALASKIN, and J. ZALESKI (*Zeit. physiol. Chem.*, 1902, 35, 246—263).—The amount of ammonia in dog's arterial blood

is very constant (average 0.41 mg. per 100 grams of blood ; in hunger 0.42 ; after administration of ammonium salts 0.42). In the portal blood, it is from 3 to 5 times greater. In animals with an Eck's fistula, the amount of ammonia increases. The auto-intoxication in such animals is due to acid products, not to the ammonia. The amount of ammonia in such organs as the brain is fairly constant ; in organs the activity of which varies, like secreting glands, it is variable. It increases in the brain when an Eck's fistula is made. It increases in the tissues and organs (except the brain) during hunger, indicating proteid katabolism. Some of the conclusions arrived at by Biedl and Winterberg (this vol., ii, 157) are criticised.

W. D. H.

**Iron in Human Liver Cells.** By P. BIELFELD (*Beitr. chem. Physiol. Path.*, 1902, 2, 251—260).—The amount of iron in the normal liver cells of women (0.05 to 0.09 per cent.) is usually less than, and varies within narrower limits than that in, the liver cells of men (0.05 to 0.36). In reference to age, the amount is least at from 20—25 years, and is then about the same in the two sexes.

W. D. H.

**Acid Formation in Autolysis of the Liver.** By ADOLF MAGNUS-LEVY (*Beitr. chem. Physiol. Path.*, 1902, 2, 261—296).—In the liver of various animals subjected to autolysis, the following non-volatile acids were separated, fermentation lactic acid, *d*-lactic acid, and succinic acid ; the volatile acids include formic, acetic, butyric, and a higher acid in small quantities ; the gases are hydrogen sulphide, hydrogen, and carbon dioxide. This occurs whether the autolysis be conducted antiseptically or aseptically. The presence of antiseptics lessens the amounts of succinic and butyric acids. Acid formation is attributed to ferment action. The possibility of a similar action during life will help to explain the increased formation of acid in certain pathological conditions such as fever, diabetes, and phosphorus poisoning. The auto-digested liver is strongly reducing ; urobilin is also formed in considerable amount, but whether from bilirubin or hæmoglobin is uncertain.

W. D. H.

**Reticulin and Collagen.** By MAX SIEGFRIED (*J. Physiol.*, 1902, 28, 319—324).—Polemical against Miss Tebb (this vol., ii, 218). The existence of reticulin as a chemical entity is still maintained.

W. D. H.

**The Presence of Arsenic in Normal Animal Organs.** By ARMAND GAUTIER (*Compt. rend.*, 1902, 134, 1394—1399). By GABRIEL BERTRAND (*ibid.*, 1434—1437).—Fresh experimental evidence is given in favour of Gautier's statement that arsenic is a normal constituent of many animal tissues and organs.

W. D. H.

**The Production of Dextrose by Muscles.** By CADÉAC and MAIGNON (*Compt. rend.*, 1902, 134, 1443—1445. Compare this vol., ii, 466).—Muscles produce sugar after death, as does the liver. If they are plunged into oil at 37°, the same amount of sugar is produced as in the muscles kept at the same temperature in the air. If they are sur-

rounded by ice, only a small amount of sugar is formed. If they are crushed, the maximum of sugar is produced. This function is independent of putrefaction.

W. D. H.

**Adrenalin.** By T. B. ALDRICH (*Amer. J. Physiol.*, 1902, 7, 359—368).—Evidence is brought forward to show that adrenalin is the reducing and blood-pressure-raising substance found in the suprarenal gland, and is not a modified or changed form of the active substance as Abel contends. Epinephrin and other "questionable" products are regarded as oxidised or changed forms of the active principle since they do not reduce Fehling's solution.

W. D. H.

**Osseo-albumoid and Chondro-albumoid.** By P. B. HAWK and WILLIAM J. GIES (*Amer. J. Physiol.*, 1902, 7, 340—358. Compare this vol., ii, 408).—The albumoid obtainable from bone after hydration of the collagen, is the substance previously described by Broesicke as keratin. It is not keratin or typical elastin, although it somewhat resembles elastin. Its percentage composition is C, 50·16; H, 7·03; N, 16·17; S, 1·18; O, 25·46. It contains no phosphorus. Chondro-albumoid, previously described by Mörner, is also free from organic phosphorus; its percentage composition is C, 50·46; H, 7·05; N, 14·95; S, 1·86; O, 25·68.

W. D. H.

**Cerebrospinal Fluid.** By EMIL ZDAREK (*Zeit. physiol. Chem.*, 1902, 35, 201—204).—The specimen of cerebrospinal fluid examined was obtained from a meningocele occurring in a woman. 370 c.c. of clear fluid were obtained, of a light yellow colour, faintly alkaline reaction, and sp. gr. 1·0018. It reduced Fehling's solution and gave characteristic crystals of phenylglucosazone. It contained neither lecithin nor cholesterol. The following table gives the results of analysis in parts per 1000 :

Dry residue .....	10·452
Organic substances.....	2·096
Proteid .....	0·768
Substances soluble in ether.....	0·358
Ash soluble in water .....	8·220
Ash insoluble in water .....	0·168

The soluble ash consisted of  $\text{SO}_3$ , 0·048; Cl, 4·245;  $\text{CO}_2$ , 0·498;  $\text{K}_2\text{O}$ , 0·167;  $\text{Na}_2\text{O}$ , 4·294; less O = Cl, 0·958; total, 8·294.

W. D. H.

**Specific Heat of Milk.** By WILHELM FLEISCHMANN (*J. Landw.*, 1902, 50, 33—76).—The results of new determinations show that the specific heats of cream, milk, and skim milk are 0·8494, 0·9407, and 0·9512 respectively. The specific heat increases slightly with the percentage of fat, and it also increases with the age of the milk.

In reference to the statement in his *Lehrbuch d. Milchwirtschaft* (1891, 36) that the fat of milk and cream is probably in a fluid state, the author now considers that when milk is kept at the ordinary



temperature (12—20°) or at lower temperatures, the fat readily solidifies.  
N. H. J. M.

**The Film on Heated Milk.** By LEO F. RETTGER (*Amer. J. Physiol.*, 1902, 7, 325—330).—The formation of a film or skin on heated milk is dependent on the presence of proteid. This proteid is caseinogen. The presence of fat facilitates film formation, but is not essential. Whilst surface evaporation facilitates film production, it is not necessary (compare Jamison and Hertz, *Abstr.*, 1901, ii, 672).  
W. D. H.

**Hæmolytic Action of Venin.** By A. CALMETTE (*Compt. rend.*, 1902, 134, 1446—1447).—The venin of snakes, especially of the cobra, hæmolyses the red corpuscles of the horse, dog, rabbit, guinea-pig, and rat rapidly; those of the ox, fowl, pigeon, and frog are more resistant. Flexner and Noguchi (*J. exp. Med.*, 1902, March 17) state that if the corpuscles are freed from serum by salt solution and centrifugalisation, they are no longer hæmolysed by venin, but that they dissolve perfectly when restored to their original serum. They conclude that the alexine of the serum is essential for the solution of the corpuscles. In the present research, on the contrary, it is found that the normal serum has anti-hæmolytic power, which is destroyed at 56°. Venin can be heated to 75° without losing its properties. The washed corpuscles are able to fix the venin, and when transferred to serum which has previously been heated at 62°, they rapidly dissolve.  
W. D. H.

**Physiological Action of Extracts of Animal Tissues.** By SWALE VINCENT and WILLIAM SHEEN (*Proc. Physiol. Soc.*, 1902; *J. Physiol.*, 28, xix—xxi).—Saline decoctions of nervous tissues, muscle, testis, kidney, spleen, pancreas, liver, stomach, intestine, lung, and mammary gland, all produce a fall of blood-pressure when intravascularly injected. Whether the depressor substance is the same throughout is uncertain. Suprarenal medulla and the infundibular portion of the pituitary body are the only tissues which yield a pressor substance. The latter contains also a depressor substance, probably of the same nature as that obtained from nervous tissues generally. The depressor substance in muscle and nervous tissues can be extracted by alcohol, but not by ether. Its action is not counteracted by atropine.  
W. D. H.

**Intestinal Calculi.** By GUSTAVE PATEIN and R. BROUANT (*J. Pharm. Chim.*, 1902, [vi], 15, 509—512).—Three intestinal calculi excreted by a patient had the following percentage composition, water 11.95, organic matter 2.00, magnesium phosphate 10.95, calcium phosphate 6.14, calcium carbonate 52.66, and sulphur 16.30. The last, a quite unusual constituent of such secretions, is supposed to have originated by the medicinal employment of the substance by the patient. A case of rectal secretion of sulphur mixed with magnesium oxide originating in this manner is also quoted.

T. A. H.

**Excretion of Indoxyl, Phenol, and Glycuronic Acid in Phloridzin Diabetes.** By PAUL MAYER (*Beitr. chem. Physiol. Path.*, 1902, 2, 217—228).—In phloridzin diabetes, no glycuronic acid passes into the urine, nor is there any increase in the excretion of phenol or indoxyl. There is no relationship between the excretion of indoxyl and phenol and that of glycuronic acid. If the excretion of this acid is increased by well-known methods, that of the aromatic substances mentioned does not rise; this conflicts with the statements made by Lewin (this vol., ii, 272).  
W. D. H.

**Lymphagogue Action of the Strawberry.** By LAFAYETTE B. MENDEL and DONALD R. HOOKER (*Amer. J. Physiol.*, 1902, 7, 380—386).—It is well known that eating certain fruits, especially strawberries, produces in a few susceptible people an urticaria comparable to that produced by eating shell-fish. This led to the question whether it is a lymphagogue. Clopatt (*Skand. Arch. Physiol.*, 1900, 10, 403) found that it was, and the present experiments on dogs confirm his conclusion. The action cannot be explained by the small amount of sugar and salt in the fruit. An aqueous extract of strawberries injected intravenously produces an increased flow from the thoracic duct, a fall of blood pressure, and a lessening of the coagulability of the blood. These effects are most marked with the first injection. There is little or no diuretic action. These facts place strawberry extract among Heidenhain's first class of lymphagogues. The lymph was observed to flow after the animal's death, and this emphasises the importance of living or "surviving" cells as a factor in lymph formation.

W. D. H.

**Method of Characterising Physiological and Pathological Proteids.** By GUSTAVE PATEIN (*J. Pharm. Chim.*, 1902, [vi], 15, 573—577).—When an animal is injected with the blood serum of an animal of a different species, the serum of the injected specimen acquires, after a period of a few days, the property of precipitating fresh serum obtained from the source of the injection. This property is not strictly specific: thus serum obtained from a rabbit originally injected with human blood serum, precipitates the latter copiously, and, in a less degree, fresh serum obtained from the dog, sheep, pig, guinea-pig, &c. All albuminous liquids produced in metabolic processes are sensitive to serum cultivated in this manner, and, conversely, such serum can be prepared by the injection of other metabolic liquids, such as urine, &c. The author discusses the experimental results which have led to these conclusions, and makes suggestions for the application of these results to the characterisation of specimens of blood and the sources of the pathological proteids of urine.  
T. A. H.

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## Chemistry of Vegetable Physiology and Agriculture.

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**Preparation of Permanent Yeast with Acetone.** By ROBERT ALBERT, EDUARD BUCHNER, and RUDOLF RAPP (*Ber.*, 1902, 35, 2376—2382).—The activity of yeast can be preserved by drying at a low temperature and then sterilising by heat (Buchner, *Abstr.*, 1897, ii, 380, and 1901, i, 179) or by killing with alcohol and ether (Albert, *Abstr.*, 1901, i, 180). Better results are obtained when the yeast is killed with acetone. The product is a white, dusty powder, containing 5.5—5.6 per cent. of water, and the yield of dried yeast is 30 to 32 per cent. In 72 hours, the dried yeast will decompose about its own weight of sucrose, and liberate about half its weight of alcohol. The activity of the yeast decreased in two cases by only 10 and 19 per cent. respectively after keeping for six months, and only one sample out of eighteen was found to be imperfectly sterilised. The acetone-yeast is more active than that dried by alcohol and ether, probably because the destructive action of the alcohol is eliminated; the fermentation also proceeds much more rapidly, the acetone-yeast liberating as much carbon dioxide in an hour as the alcohol-ether yeast in 3 hours.  
T. M. L.

**Effect of Nitrogen on Nitrates, and of Humous Substances on the Inoculation of Leguminous Plants.** By FRIEDRICH NOBBE and L. RICHTER (*Landw. Versuchs-Stat.*, 1902, 56, 441—448).—Pot experiments are described in which oats and soy beans, both separately and mixed, were grown in humous soil and a mixture of the soil with sand. In each case, one set of pots was inoculated, the other not; and in the case of the mixed soil there were additional pots which received potassium nitrate (5 and 10 grams respectively). The inoculation was effected by means of an extract of soy bean soil from Japan.

It was found that the effect of inoculation was diminished both by the nitrogenous matter of the soil and by the nitrate added. The activity of the nodule bacteria was increased when oats were grown with beans, owing to the oats taking the nitrates from the soil.

The yield of oats was greater when the oats were grown with beans than when grown alone.  
N. H. J. M.

**Amino-acids as Food Material for Lower Forms of Plant Life.** By OSKAR EMMERLING (*Ber.*, 1902, 35, 2289—2290).—Only certain amino-acids can act as food material for moulds, and even closely allied acids behave in very different manner. Of  $\alpha$ - and  $\beta$ -amino-acids, the former only can act as food material and these only for certain moulds.  $\gamma$ -Aminobutyric acid is an excellent food for all the moulds investigated;  $\alpha$ -aminobutyric acid, *i*-leucine, and tyrosine are of but little value as food supplies. Of the aromatic compounds, 2-pyrrolidinecarboxylic acid is one of the most nutritious foods, and so also to a certain extent is phenylalanine.

$\alpha$ -Amino- $\beta$ -hydroxypropionic acid is an admirable food, but  $\beta$ -amino- $\alpha$ -hydroxypropionic acid is absolutely useless.

The experiments were made with *Penicillium glaucum*, *Aspergillus niger*, *A. clavatus*, *A. oryzae* and *Mucor mucedo*. The results are not always the same with different moulds. J. J. S.

**Function of Peroxides in Cell-life.** By A. BACH and ROBERT CHODAT (*Ber.*, 1902, 35, 2466—2470. Compare this vol., ii, 344).—The oxydases of the plant cell have the power of forming peroxides in the presence of free oxygen, and these can be detected by the liberation of iodine from hydriodic acid. The juice of *Lathraea squamaria* contains an oxydase, which turns tincture of guaiacum blue, and in the presence of oxygen this juice yields, with barium hydroxide, a precipitate which liberates iodine from hydriodic acid, but does not react with titanous and sulphuric acids. This substance, therefore, has the properties of an acylated hydroperoxide. When the juice is kept until the guaiacum reaction disappears, the peroxide reaction also disappears. Liberation of iodine is also brought about by the freshly-cut stems of a large number of plants, and the peroxide may be detected by the same reaction in the living cells of the potato.

A. H.

**Has Hydrogen Peroxide a Function in Cell-life?** By OSCAR LOEW (*Ber.*, 1902, 35, 2487—2488).—The facts adduced by Chodat and Bach (this vol., ii, 344) do not prove the presence of hydrogen peroxide in the cells of the moulds growing in solutions containing this substance. Since these moulds are very rich in catalase their comparative immunity towards hydrogen peroxide may be due to the rapidity with which the cell is able to decompose this substance.

A. H.

**Decomposition of Carbohydrates in Germinating Dates.** By J. GRÜSS (*Chem. Centr.*, 1902, i, 942; from *Ber. deut. bot. Ges.*, 20, 36—44).—Whilst  $\alpha$ -mannan from date seeds yields mannose in presence of malt or yeast diastase, Reiss failed to detect mannose in germinating dates.

By keeping endosperms from date plants two months old in water with thymol as antiseptic, a solution was obtained which contained mannose, as well as galactose, sucrose, and invert sugar. The amount of reducing sugar is less than 1 per cent. of the weight of the endosperm. The sucrose was no doubt present in the embryo before germination.

N. H. J. M.

**Transformations of Proteids during Germination.** By GUSTAVE ANDRÉ (*Compt. rend.*, 1902, 134, 995—998).—The total nitrogen and the nitrogen as proteids, legumin, and soluble amides, was determined in haricot seeds and in seedlings at five different periods from June 1 to June 13.

The results showed that the production of new proteids commenced when the weight of the dry matter of the seedlings reached that of the original seeds. At the same time, the total nitrogen which had remained stationary began to increase.



The legumin diminished rapidly during germination, but did not disappear completely. When, however, the seeds were germinated in darkness, the seedlings (a month old) were found to have lost the whole of the legumin and albumin, whilst the soluble nitrogen amounted to 83.5 per cent. of the total. N. H. J. M.

**Transpiration of Apples.** By RICHARD OTTO (*Landw. Versuchs-Stat.*, 1902, 56, 427—439. Compare Abstr., 1901, ii, 678).—The results of experiments in which apples were kept under a bell jar showed that there was a slight loss of water in nearly every case. The whole of the starch disappeared in 23 days, whilst the invert sugar increased. The sp. gr. of the must was increased by transpiration, especially in the case of unripe fruit. The amount of malic acid diminished, whilst there was an increase in the amount of extract. A second series of experiments is described, in which the apples were kept under the usual conditions.

The conclusion is drawn that transpiration is advantageous to the production of cider in the case of unripe apples, especially when they contain much starch, provided that the process is not of too long duration (more than 3—4 weeks). N. H. J. M.

**The Boric Acid Controversy.** By EDMUND O. VON LIPPMANN (*Chem. Zeit.*, 1902, 26, 465).—Attention is called to the natural occurrence of traces of boric acid in lemons, oranges, and other fruits grown in southern climes. L. DE K.

**Acids of Bignonia Catalpa.** By ARNALDO PIUTTI and E. COMANDUCCI (*Bull. Soc. Chim.*, 1902, [iii], 27, 615—620).—From the unripe fruits of *Bignonia catalpa*, the authors have obtained *p*-hydroxybenzoic acid (Sardo's catalpic acid, Abstr., 1885, 272) and a compound of *p*-hydroxybenzoic and protocatéchuic acids,  $C_7H_6O_3, C_7H_6O_4, 2H_2O$ . They incline to the belief that these acids exist in the fruit in the form of glucosides, but this point is being further investigated. A. F.

**Prussic Acid in the Opening Buds of Prunus.** By E. VERSCHAFFELT (*Proc. K. Akad. Wetensch. Amsterdam*, 1902, 5, 31—41).—The hydrocyanic acid present in the buds of *Prunus Laurocerasus* and *P. Padus* increases in amount in the fresh shoots, whether grown in the light or in the dark. The hydrocyanic acid is present as a glucoside similar to amygdalin, and is not drawn from the internodes of the previous year's growth. G. Y.

**Mechanism of the Chemical Changes in Plants Subjected to the Influence of Sodium Nitrate.** By EUGÈNE CHARABOT and ALEXANDRE HÉBERT (*Compt. rend.*, 1902, 143, 1228—1230).—Six rows of peppermint plants about 4 metres long were watered on May 23rd with a solution of 500 grams of sodium nitrate in 20 litres of water and the proportions of water, organic matter, esters, and essential oils in the plants were determined from time to time. The results show that when the plant reaches a suitable stage of development the relative proportion of water diminishes and the proportion of organic

matter increases more markedly under the influence of sodium nitrate than under normal conditions. Sodium nitrate also causes the production of an essential oil constantly richer in esters and poorer in menthol and menthone than that formed under normal conditions. The effect of sodium nitrate is therefore similar to that of sodium chloride, although the mechanism of the influence is probably not the same, since sodium nitrate increases the chlorophyllien function whilst sodium chloride reduces it.

C. H. B.

**Number and Depth of Roots of Different Plants with Various Manures.** By CONRAD VON SEELHORST (*J. Landw.*, 1902, 50, 91—104. Compare Abstr., 1899, ii, 508).—The results obtained with a variety of plants showed that manuring increased, not only the development of the roots, but also their depth in the soil. The soil on which the experiments were made was very uniform, and it is suggested that divergent results might be obtained when the subsoil differs to any extent from the surface soil. The results are of practical importance as they indicate that one effect of manuring, at any rate on suitable soils, is to increase the power of crops to resist the effects of drought by increasing the depth of the roots.

N. H. J. M.

**Chicory and the Production of Leaves.** By EM. CARPIAUX (*Bied. Centr.*, 1902, 31, 403—406; from *Bul. Inst. Gembloux*, 1901, No. 70, 17).—When chicory roots were allowed to produce new growth much of the inulin (20 per cent.) was utilised. Of the ash constituents, the roots lost much of the potassium but very little of the phosphoric acid originally present. There was also a considerable reduction (about 15 per cent.) in the total nitrogen of the roots. The nitrogenous substances, both proteids and non-proteids, undergo, however, no essential change, but merely migrate to the newly-formed growth.

N. H. J. M.

**Manurial Experiments with Potassium and Phosphoric Acid on Barley.** By THEODOR REMY and O. NEUMANN (*Bied. Centr.*, 1902, 31, 374—379; from *Bl. Gersten-, Hopfen-, u. Kartoffelbau*, 1901, 227, 261, 305, and 337).—Twenty-nine field experiments were made in different parts of Germany in which barley was grown without manure, with 12·5 lb. of potash (as 40 per cent. potassium salts), with 10 lb. of phosphoric acid (as superphosphate), and with the same amounts of potassium salts and superphosphate together per half morgen. On the whole, the two manures had almost the same effect on the production of grain, whilst potassium had the greater effect on straw production. The results varied according to the nature of the soil. The percentage number of cases in which the manures were decidedly effective on light and heavy soils respectively are as follows:

	Potassium salts.	Superphosphate.	Both manures.
Light soils.....	42·9	64·3	85·7
Heavy soils .....	83·3	83·3	100·0

Vegetation experiments were made with the same soils in pots.

Potassium was applied as chloride and phosphoric acid as monocalcium salt, and all the pots received nitrogen (as ammonium nitrate) and calcium carbonate. The amounts of proteids in the grain varied only slightly. Phosphoric acid increased the yield without increasing the weight of the grains. Potassium, on the other hand, increased both the yield and the weight of the grains, the number of grains being unaltered.

N. H. J. M.

**Manurial Experiments with Barley.** By RUDOLF ULRICH (*Bied. Centr.*, 1902, 31, 380—381; from *Fühling's Landw. Zeit.*, 1900, 533).—As regards the effect of manuring on the quality of barley, it was found that the application of manures increased the percentage of water, and, especially in the case of potassium manures, the amount of starch in the air-dried grain, and that nitrogenous manures increased the percentage of proteids, which was diminished by potassium and phosphatic manures when applied in large amounts. The percentage of starch increases almost equally with the dry matter.

Peruvian guano containing N, 7;  $K_2O$ , 4; and  $P_2O_5$ , 10.5 per cent. is recommended for barley.

N. H. J. M.

**Rye and Wheat.** By F. BARNSTEIN (*Landw. Versuchs-Stat.*, 1902, 56, 369—418).—The paper contains analyses of rye and wheat grain, bran, and meal by different investigators, as well as some new analyses; the botanical characters of the plants and the feeding values of bran and meal are also discussed in detail.

N. H. J. M.

**Digestion of Maize by Fowls.** By SIMEON PARASCHITSCHUK (*J. Landw.*, 1902, 50, 15—32).—The results of experiments with fowls indicate that they digest the constituents of maize to about the same extent as larger animals; the results resemble those furnished by pigs rather than those obtained with horses and cattle. Previous investigators obtained much lower results as regards crude fibre.

N. H. J. M.

**Relation of the Chemical Composition and Anatomical Character to the Value of Potato Tubers.** By FR. WATERSTRADT and M. WILLNER (*Bied. Centr.*, 1902, 31, 329—331; from *Bl. Gersten-, Hopfen-, u. Kartoffelbau*, 1901, 293).—The outer layer of fresh potatoes contains considerably more starch, crude fibre, and, generally, proteid, but less non-proteid nitrogen, and usually less total nitrogen than the marc. The amounts of proteid nitrogen and starch in the dry matter of the outer layer do not differ much from those in the dry matter of the marc, but as a rule the latter contains rather more proteids.

In the case of varieties of potatoes which give large yields, the tubers contain relatively more marc tissues than varieties which give small yields. There seems to be no relation between the feeding value of potatoes and the amounts of dry matter, starch, and nitrogen, &c., which they contain, but in the better varieties it is found that the relation between starch and total nitrogen is a narrow one.

N. H. J. M.

**Relation between the Amounts of Phosphoric Acid and Ammonia in Plants, especially in Sugar-beets.** By HENRI PELLET (*Zeit. Ver. deut. Zuckerind.*, 1902, 555, 390—393).—It was shown by Champion and Pellet (*Abstr.*, 1876, 420, and 1880, 569) that plants always contain ammoniacal nitrogen, and that the quantities of ammonia and phosphoric acid present are such as are required for the formation of ammonio-magnesium phosphate. The author now gives the results of an examination of Egyptian beets grown in soil formed by the gradual accumulation of Nile mud and containing only traces of either ammonia or nitric acid. In this case also, however, the above relation between the quantities of ammonia and phosphoric acid is found to hold.

T. H. P.

**Action of Nitrogen in Absence of other Nutritive Substances.** By H. WILFARTH (*Bied. Centr.*, 1902, 31, 430—431; from *Bl. Zuckerribbenbau*, 1901, 15).—Sugar-beets grown without potassium and with little nitrogen contained 11.03 per cent. of sugar. With large amounts of nitrogen, but without potassium, the roots contained 0.0062 per cent. of sugar. Potatoes, similarly manured, contained 14.6 and 9.76 per cent. of starch respectively. Exclusive nitrogenous manuring has therefore the reverse of the desired effect.

N. H. J. M.

**Alterations in the Composition of the Beet during Ripening.** By KARL ANDRLÍK, VL. STANĚK, and K. URBAN (*Zeit. Zuckerind. Böhm.*, 1902, 26, 343—363).—The authors have made exhaustive analyses of the leaves, leaf-stems, and roots of beets pulled at different times during the harvest. An account is given of the methods employed and results obtained, and also of those of previous workers in this direction.

The analytical numbers show that the value of the leaves and leaf-stalks as manure diminishes during the maturation of the plant, but that their food-value remains practically unaltered. The quality of the roots is improved very considerably owing to a diminution in the amount of alkalis, nitrogen, and reducing matters.

T. H. P.

**Cultivation of Mangels on the Experimental Fields at Grignon in 1900 and 1901.** By PIERRE P. DEHÉRAIN and C. DUPONT (*Compt. rend.*, 1902, 134, 953—958).—Sugar mangels gave decidedly better results than the older kinds. The red variety is most suitable for dry soils and the white variety for wet soils.

N. H. J. M.

**Production of Milk and Butter. Variations in the Composition of Butter.** By L. MALPEAUX and J. DELATTRE (*Ann. Agron.*, 1902, 28, 209—223. Compare this vol., ii, 168).—Beet pulp does not affect the taste of butter as sometimes stated; it may cause a reduction in the amount of volatile acids, and the same effect is produced by brewer's grains and green fodder. Horse beans increased the volatile acids. Oleaginous foods greatly alter the composition of butter by causing a reduction in the percentage of volatile fatty acids.



The effects of race, individuality, period of gestation, and season are also discussed.  
N. H. J. M.

**The Influence of Feeding on the Composition of the Fat of Milk.** By B. SJOLLEMA (*Proc. K. Akad. Wetensch. Amsterdam*, 1902, 6, 746—756).—In some parts of the Netherlands at certain seasons the butter obtained has a high refraction number and a low Reichert-Meissl-Wollny number, which depends on the small amount of volatile fatty acid. Such butter is suspected of adulteration and its sale has been prohibited in some countries. The peculiarity is largely dependent on feeding. Feeding on beet foliage raises the R.M.W. number, and experiments with molasses indicate that it is mainly the sugar contained in the beet-leaves which acts favourably by increasing the amount of lower fatty acids.  
W. D. H.

**Chemical Changes in Peat Soil after Several Years' Cultivation and Manuring.** By HJALMAR VON FEILITZEN (*Bied. Centr.*, 1902, 31, 362—365; from *Svenska Mosskulturfor. Tidskr.*, 1901, 319—329).—The soil of the experimental field at Flahult consists mainly of very slightly decomposed peat, about 3 metres deep. Some of the plots had an application of sand (500 cubic metres per hectare); it was found after 8 years that practically the whole of the sand remained near the surface.

Analyses of the soil made in 1892, 1894, and 1900 showed that the nitrogen, potassium, and phosphoric acid increased in the course of six years. The surface soil of the plots to which sand had been added gained less phosphorus, but more potassium, than those which did not have an application of sand. The percentage of nitrogen showed a marked increase, but for cereals and root crops it is necessary to apply nitrogenous manures.

In addition to the peat soil, the Flahult experiments include plots on humified peat containing 2.89 per cent. of nitrogen. Some plots remained without sand, others had an application of sand which was mixed with the soil, whilst a third series received a layer of sand. The surface soil became considerably richer in phosphoric acid during the experimental period, and there was also a gain of potassium, but considerable amounts of potassium and calcium descended to the subsoil.

N. H. J. M.

**Manurial Experiments on Peat Land.** By HJALMAR VON FEILITZEN (*J. Landw.*, 1902, 50, 77—90. Compare Abstr., 1896, ii, 269).—A résumé of results of some of the experiments conducted at Jönköping and Flahult during the last 13 years.

The peaty soil contains very little potash. A certain amount of potash is frequently supplied in sand or loam applied to the land, but, as a rule, manuring with potassium is of great importance. The potassium of peat soil is comparatively readily soluble and a good deal may be lost in drainage; a certain amount is, however, retained by the soil and this amount tends to increase.

The Swedish peat soils are very poor in phosphoric acid with the few exceptions of those which contain vivianite, and even these

require applications of phosphoric acid from time to time. Basic slag, superphosphate, and Wiborgh phosphate are about equally suitable manures for peat soil; bone meal, Algerian, Somme, and Belgian phosphates are less suitable, whilst apatite, Lahn phosphorite and Redonda phosphate are too insoluble in undecomposed peat land. The soil retains phosphoric acid with great tenacity, and the drainage contains only traces of phosphoric acid.

Whilst one variety of peat soil is very rich in nitrogen, the other ("Hochmoor") contains very little. Of the different manures (sodium nitrate, ammonium sulphate, and fish guano), sodium nitrate is the most suitable for peat land. The chief value of dung when applied to peat is in connection with the microbes thus introduced, as they are of importance in the decomposition of the insoluble nitrogenous matter.

N. H. J. M.

**Manurial Action of Bone Meal Phosphoric Acid.** By OSCAR KELLNER and O. BÖTTCHER (*Bied. Centr.*, 1902, 31, 305—307; from *Deut. landw. Presse*, 1901, Nos. 23 and 24. Compare Abstr., 1901, ii, 275).—The unfavourable results obtained with bone meal by Wagner and Maercker are attributed to the simultaneous application of calcium carbonate and to the experiments having been made on soil rich in calcium.

The slower action of bone meal as compared with basic slag and superphosphate is shown by applying the three manures in the spring to a quick-growing plant such as white mustard; in this case, the bone meal gave very inferior results as compared with the other two manures. Addition of 15 grams of calcium carbonate to the 3.5 kilos. of soil reduced the yield in each case, but to the largest extent with bone meal. A greater amount of carbonate (30 grams) had very little or no further effect in reducing the yield where basic slag and superphosphate were employed, but in the case of bone meal reduced the yield by about 50 per cent.

The conclusion is drawn that phosphoric acid should not be applied to soils when limed, unless the soil has already received plenty of phosphoric acid.

N. H. J. M.

**[Manurial] Action of Nitrogen as Nitrates and as Ammonia.** By MAX GERLACH (*Bied. Centr.*, 1902, 31, 371—372; from *Jahresber. Landw. Versuchs-Stat. Posen*, 1900—1901, 11).—The effect of nitrogen in the form of sodium nitrate and as ammonium salts is almost the same when the soil contains sufficient amounts of sodium, potassium, and calcium. But sodium nitrate gives decidedly better results than ammonium salts when the soil is deficient in these substances.

N. H. J. M.

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## Analytical Chemistry.

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**New Form of Abich's Mortar.** By W. I. IWANOFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 397).—The author proposes to modify the well-known steel mortar used for powdering minerals by cutting the cylindrical portion, in which the pestle fits, longitudinally into two halves, these being held together by a ring which screws on to the base. Such an arrangement, views of which are given, allows of the mortar being readily taken to pieces. T. H. P.

**The Literature of Volumetric Solutions and the Substances employed for Standardising them.** By LUDWIG VANINO and E. SEITTER (*Zeit. anal. Chem.*, 1902, 41, 141—218).—A compendium of the processes and materials employed for preparing standard solutions, with references to the original papers. M. J. S.

**Inapplicability of Winkler's Method of Fractional Combustion of the Hydrogen to the Examination of Natural Gas.** By K. CHARITSCHKOFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 393—395).—In determining hydrogen when mixed with methane, Winkler recommends the combustion of the hydrogen by means of slightly palladinised asbestos. This method cannot, however, be employed for natural gases, since these contain constituents, such, for instance, as isopentane, which would undergo oxidation at the same time as the hydrogen. T. H. P.

**Estimation of Perchlorate in Saltpetre.** By AUGUSTE DUPRÉ (*J. Soc. Chem. Ind.*, 1902, 21, 825—826).—Twenty grams of the sample are introduced into a covered 70 c.c. nickel crucible and the perchlorate is reduced to chloride by heating for an hour in a Gilbert's furnace at 545°. The mass is then dissolved in water and the solution made up to 200 c.c. After estimating the chlorine in 25 c.c. by Mohr's method, 100 c.c. are precipitated with a small excess of standard silver solution (1 c.c. = 0.001 chlorine), 4 c.c. of strong nitric acid are added, and after boiling and subsequent cooling the liquid is filtered and the excess of silver estimated by Volhard's thiocyanate method.

Allowance must, of course, be made for any chloride existing as such; this is estimated in 10 grams of the original sample as directed. L. DE K.

**Detection of Fluorides in Butter.** By OTTO HEHNER and CHARLES W. HEHNER (*Analyst*, 1902, 27, 173—179).—Fifty grams of the butter are melted in a beaker after rendering slightly alkaline. The aqueous portion is drawn off, a little calcium chloride is added, the liquid is heated to boiling, and a small excess of sodium carbonate added to precipitate the calcium compounds. The precipitate, consisting of calcium borate (if borates be present in

the butter), fluoride, carbonate, phosphate, and probably sulphate, is filtered off, ignited, and treated with hot dilute acetic acid to dissolve out the carbonate, borate, and phosphate. The residue is again collected on a filter, washed, and ignited in a platinum crucible. When cold, a drop of concentrated sulphuric acid is added and the crucible covered with a waxed glass plate on which scratches have been made with a pin. The crucible and its contents are then gently heated on a sand-bath for 2 hours. Should fluorides be present, the glass is etched. It was found that 1 mg. of calcium fluoride gave a distinct etching on the glass. W. P. S.

The "Natromètre." By DÉMICHEL (*Ann. Chim. anal.*, 1902, 7, 204—209).—A mathematical criticism of Pésier's old and new "natromètre" unsuitable for useful abstraction. L. DE K.

Test for Nitrogen in Pyrrole Compounds by Lassaigue's Method. By EDUARD A. KEHRER (*Ber.*, 1902, 35, 2523—2525).—The usual procedure is altered, so that the sodium (or potassium) is heated first in a constriction of the test-tube, and then the substance, which has been placed in the wider portion. The vapours of the substance thus pass over the molten metal with a more certain formation of cyanide. R. H. P.

Arsenic in Glycerol. By J. BOUGAULT (*J. Pharm. Chim.*, 1902, [vi], 15, 527—529).—The method employed by Engel and Bernard (*Abstr.*, 1896, ii, 448) is recommended for the detection of arsenic in glycerol. 0.004 gram per litre can be readily detected by this process. T. A. H.

Separation of Arsenic, Tin, and Antimony. By WILLIAM R. LANG, C. M. CARSON, and J. C. MACKINTOSH (*J. Soc. Chem. Ind.*, 1902, 21, 748).—The solution containing the hydrochloric acid solution of the three metals is, if necessary, first reduced by means of sulphur dioxide, and the metals are then precipitated as sulphides. The washed precipitate is evaporated to dryness with 15 c.c. of strong nitric acid, the residue treated with 100 c.c. of warm water, and the arsenic acid in the filtrate precipitated, as usual, with magnesia mixture, and finally weighed as pyroarsenate. The antimony is then separated from the tin oxide by digesting for an hour with solution of tartaric acid, and the undissolved tin oxide ignited and weighed. The antimony is precipitated by adding a little hydrochloric acid and passing hydrogen sulphide, the sulphide is then converted into oxide by nitric acid, and, after ignition, weighed as the tetroxide.

Experiments made to quantitatively separate the sulphides of tin and antimony from arsenic trisulphide by means of strong hydrochloric acid were unsuccessful, as a varying amount of arsenic trisulphide also dissolves. L. DE K.

Rapid Estimation of Boric Acid in Butter. By H. DROOP RICHMOND and JOHN B. P. HARRISON (*Analyst*, 1902, 27, 179—181).—Twenty-five grams of the butter are weighed out into a beaker, and



25 c.c. of a solution containing 6 grams of milk sugar and 4 c.c. *N* sulphuric acid in 100 c.c. are added. The beaker is placed in the water-oven until the fat has just melted, and the contents are stirred well. After allowing the aqueous portion to settle for a few minutes, 20 c.c. are drawn off, a little phenolphthalein added, brought to the boiling point, and titrated with *N*/2 soda until a faint pink colour just appears. Twelve c.c. of neutral glycerol are now added, and the titration continued until a pink colour appears. The difference between the two titrations multiplied by 0.0368 gives the amount of boric acid in 20 c.c., and this, multiplied by  $\frac{100 + \text{percentage of water in the butter}}{20}$

will give the percentage of boric acid. The estimation is not affected by the phosphoric acid, butyric acid, or milk sugar present in the butter. W. P. S.

**New Process for the Volumetric Evaluation of Red Lead.** By E. SZTERKHERS (*Ann. Chim. anal.*, 1902, '7, 214—217).—A solution is made containing exactly 10 grams of recrystallised sodium nitrite per litre. By means of this solution, a solution of potassium permanganate containing approximately 8 grams of this salt per litre is standardised as follows: 50 c.c. of dilute sulphuric acid (1 : 4) and 300 c.c. of water are heated to 40°, 50 c.c. of the permanganate are introduced, and the nitrite is then added with constant agitation until the liquid is decolorised.

Five grams of the sample of red lead are heated with 100 c.c. of boiling water and 5—7 c.c. of pure nitric acid for 15 minutes on the water-bath. After cooling to 50°, the nitrite is added drop by drop until the dioxide has completely dissolved, and after noting the amount used, the excess of nitrite is titrated with permanganate. The number of c.c. of nitrite solution decomposed by the red lead multiplied by 0.693 equals the percentage of lead dioxide in the sample. Absolutely pure red lead contains 34.8 per cent. of lead dioxide. L. DE K.

**Thallium. I. Estimation of Thallium in the Thallous State.** By VICTOR THOMAS (*Bull. Soc. Chim.*, 1902, [iii], 27, 470—471).—In estimating thallium, the author oxidises the thallous salt to thallic salt by means of hydrobromoaauric acid, the latter being reduced with deposition of metallic gold, according to the equation  $3\text{TlCl} + 2\text{AuBr}_3 = 3\text{TlClBr}_2 + 2\text{Au}$ .

The hydrobromoaauric acid is easily obtained by dissolving gold in hydrobromic acid containing bromine and evaporating on the water-bath, when it is deposited in long, dark coloured needles. A. F.

**Volumetric Estimation of Copper by Potassium Iodide.** By FRANZ M. LITERSCHIED (*Zeit. anal. Chem.*, 1902, 41, 219—227).—Besides the method of Mohr (*Lehrbuch*) and Vitali (*Abstr.*, 1895, ii, 140), a process may be based on the measurement of the amount of potassium iodide consumed in precipitating the copper as cuprous iodide in presence of sulphurous acid. The neutral or feebly acid (sulphuric, nitric, or acetic acid, compare Low, *Eng. and Min. Journ.*, 1895, 124) cupric solution is mixed with sulphurous acid and a small

excess of  $N/10$  potassium iodide. After reposing for an hour for the precipitate to aggregate, the whole is made up to a known volume (200—500 c.c. for 0.1 gram of copper), and to an aliquot part of the clear solution an excess of  $N/10$  silver nitrate is added. The excess of silver is then titrated by Volhard's thiocyanate method. The presence of nickel and zinc requires no modification of the process. Silver can be estimated by converting the metals into sulphates and titrating the silver by potassium iodide in presence of a trace of a nitrite with starch as indicator. The entire mixture is then treated as above for the estimation of the copper. If bismuth is also present it must be separated as oxychloride, or, in the absence of silver, the bismuth may be removed as basic carbonate and the ammoniacal filtrate at once acidified with acetic acid and used for the estimation of copper. Lead must be separated as sulphate, then as metastannic acid, before employing the process for titrating the copper.

M. J. S.

**Volumetric Estimation of Copper.** By SAMUEL W. PARR (*J. Amer. Chem. Soc.*, 1902, 24, 580—581).—A slight modification of the method recently communicated (Abstr., 1900, ii, 762).

The washed cuprous thiocyanate, together with the asbestos, is returned to the beaker. Ten c.c. of a 10 per cent. solution of potassium hydroxide and then 10 c.c. of ammonia of sp. gr. 0.96 are added, and the mixture is without delay titrated with standard permanganate, until on warming to 45—55° the green colour remains. About one-fourth of the quantity of permanganate already used is added, and after cooling for five minutes 25 c.c. of dilute sulphuric acid (1:2) are added and the titration continued to the end. The reaction is sharp and the results are concordant.

L. DE K.

**Electrolytic Estimation of Mercury.** By EMIL BINDSCHEDLER (*Zeit. Elektrochem.*, 1902, 8, 329—332).—The estimations, made by electrolytic deposition of the mercury on a matt-surfaced platinum dish, from solution in sulphuric acid or potassium cyanide, were always too low. The reason was found in the evaporation of the deposited mercury, which is readily avoided by keeping the temperature as low as possible and taking care that the deposit of mercury is always covered by the electrolyte. The results are then very accurate.

T. E.

**Stukowenkow's Method for the Estimation of Mercury in Urine.** By BRUNO BARDACH (*Zeit. anal. Chem.*, 1902, 41, 232—235).—An attempt to obtain quantitative results by the method described in Abstr., 1901, ii, 579, by comparing the rings of mercuric iodide with standards, showed that under the conditions laid down by Malkes (*Chem. Zeit.*, 1900, 24, 816) no such results are obtainable. Although 5 c.c. of egg-albumin precipitates traces of mercury completely from 500 c.c. of urine, the precipitation becomes incomplete when the mercury amounts to 3.5 mg. Further, the precipitation by a copper spiral is very imperfect unless the quantity of copper gauze used is so much increased that the subsequent expulsion of the mercury, and its

collection as iodide in a definite ring, are seriously impeded. The method can therefore only be employed as a rough qualitative one.

M. J. S.

**Use of Persulphates in Analysis.** By HENRY D. DAKIN (*J. Soc. Chem. Ind.*, 1902, 21, 848—849).—*Estimation of Manganese.*—Manganese is completely precipitated by adding to the solution, heated at 50°, a solution of ammonium persulphate followed by a moderate excess of ammonia. The precipitate does not lend itself to volumetric estimation owing to the variable composition of the oxide formed, but the gravimetric determination as manganous sulphate is satisfactory.

*Oxidation of Chromium Salts.*—Chromic salts are completely converted into chromates by boiling with large excess of potassium or sodium hydroxide and adding potassium persulphate. Attempts to substitute the ammonium compounds for the fixed alkalis ended unsatisfactorily.

*Estimation of Nitrogen.*—The author believes that potassium persulphate will be a great service in Kjeldahl's process. After heating for a while with the usual mixture of sulphuric acid and potassium sulphate, the acid is allowed to cool below 100° and a few grams of the persulphate are added; if not yet fully oxidised, the liquid should be again heated, and after cooling again treated with persulphate. It is probable that ammonium persulphate may be useful for the destruction of organic matter in toxicological investigations. L. DE K.

**Qualitative Test for Cobalt.** By J. L. DANZIGER (*J. Amer. Chem. Soc.*, 1902, 24, 578—580).—About 5 c.c. of the solution acidified with hydrochloric acid are mixed in a test-tube with some solid ammonium thioacetate, a few drops of solution of stannous chloride are added, and the mixture is shaken with 5 c.c. of amyl alcohol. In the presence of cobalt, the upper layer will show a more or less decided blue colour. Instead of amyl alcohol, a mixture of acetone and ether, or of alcohol and ether, may be used, but amyl alcohol is most efficient.

The reaction is due to the formation of a double compound of ammonium and cobaltous thioacetate. One part of cobalt may thus be detected in 500,000 parts of liquid. The addition of stannous chloride serves to reduce any ferric iron. L. DE K.

**Volumetric Estimation of Molybdenum in Molybdenum Steel and Ferro-Molybdenum.** By JAMES BRAKES (*J. Soc. Chem. Ind.*, 1902, 21, 832).—A modification of Kopp's method (this vol., ii, 430). Five grams of the sample are dissolved in a beaker in a mixture of 20 c.c. of nitric acid and 20 c.c. of hydrochloric acid and evaporated to dryness; the mass is redissolved in 10 c.c. of hydrochloric acid, 20 c.c. of dilute sulphuric acid (1 : 1) are added, and the solution is evaporated until fumes of sulphuric acid appear. When cold, 400 c.c. of water are added and the liquid is heated until solution is complete. The solution is now transferred to a litre flask, 100 c.c. of ammonia of sp. gr. 0.90 are added, and after standing in cold water for an hour the contents are made up with water to the mark. Five hundred c.c.

of the filtrate are mixed with 40 c.c. of sulphuric acid of sp. gr. 1.60, passed through the reductor, and titrated with permanganate. After deducting the amount indicated by a blank experiment, the value of the permanganate in iron is multiplied by 0.605. Tungsten must be removed before the evaporation with sulphuric acid; chromium exercises no influence on the titration, even when as much as 8 per cent. is present.

L. DE K.

**Technical Estimation of Tin in Solutions of Pink Salt.** By OSKAR GEISEL (*Chem. Zeit.*, 1902, 26, 553—554).—The solution, which should not contain any excess of hydrochloric acid, is titrated with *N*/10 sodium hydroxide, using malachite-green as indicator, until the liquid turns a pure blue, which does not get darker on adding more sodium hydroxide.

It is essential that the liquid should only contain from 0.075—0.100 gram of tin oxide in 10 c.c., to which a sufficiency of a 1 per cent. solution of malachite-green is added. Seven mols. of sodium hydroxide represent 2 mols. of stannic chloride. The test analyses seem promising.

L. DE K.

**Aromatic Bases as Precipitants for Rare Earth Metals.** By ALICE MACMICHAEL JEFFERSON (*J. Amer. Chem. Soc.*, 1902, 24, 540—562).—Zirconium nitrate is quantitatively precipitated by aniline, *o*-toluidine, xyldine, dimethylamine, diethylamine, benzylamine, pyridine, piperidine, and quinoline, but phenylhydrazine gives no precipitate. Thorium nitrate is also precipitated; benzylamine and diphenylamine were not tried, and phenylhydrazine gives a precipitate soluble in excess. Cerium nitrate is quantitatively precipitated except by xyldine, dimethylamine, and quinoline, whilst phenylhydrazine and diphenylamine give no precipitate at all.

Lanthanum chloride or its double ammonium nitrate compound is quantitatively precipitated by benzylamine and piperidine, but only partially so by pyridine and phenylhydrazine, whilst the other bases give no precipitate; diphenylamine was not tried. The same remarks practically apply to praseodymium and neodymium.

**Separations.**—Thorium may be quantitatively separated from neodymium by precipitating the nearly neutralised solution with quinoline; in the same way, zirconium may be separated from neodymium. Thorium may be separated from lanthanum by aniline. Zirconium may also be separated from lanthanum in the same manner. Thorium may also be separated quantitatively from lanthanum by precipitation with quinoline. Cerium may be separated from praseodymium by means of *o*-toluidine. Thorium is separated from praseodymium by means of aniline. Zirconium may be separated from lanthanum and also from praseodymium by means of xyldine. (For minute details to be observed in the separations, the original article should be consulted.)

L. DE K.

**New Apparatus in Water Analysis.** By GEORGE E. THOMAS and CLARENCE A. HALL (*J. Amer. Chem. Soc.*, 1902, 24, 535—539).—A description of a battery of six stills used in the determination of



ammonia in water by the Wanklyn method; of an apparatus for collecting samples of water for the purpose of estimating the dissolved oxygen or carbon dioxide, and of an arrangement for collecting suspended matter on asbestos. Full illustrations are given. L. DE K.

**Estimation of Ammonia in Waters.** By OSKAR EMMERLING (*Ber.*, 1902, 35, 2291).—Proteids interfere with the usual estimation of ammonia by Nessler's reagent. It is therefore necessary that waters containing proteids should be boiled with magnesia or lead oxide and the ammonia estimated in the distillate. J. J. S.

**Estimation of Nitrates in Water by the Indigo-Carmin Method.** By SAMUEL R. TROTMAN and HAROLD PETERS (*J. Soc. Chem. Ind.*, 1902, 21, 694—695).—Five to 20 c.c. of the sample of water are mixed with 25 c.c. of (Löwenthal's) indigo-carmin solution, and to the liquid is added an equal bulk of sulphuric acid; the whole is then heated on the sand-bath for 15 minutes. At the same time, a blank determination is made with distilled water and indigo-carmin. Both solutions are then titrated with standard permanganate, and the difference between the two titrations represents the nitrogen. The permanganate is standardised by means of a solution of potassium nitrate containing 0.0001 gram of nitrogen per c.c. The results correspond with those obtained by using the nitrometer. L. DE K.

**A New Colour Reaction of Thiophen.** By HANS KREIS (*Chem. Zeit.*, 1902, 26, 523).—A solution of thiophen in benzene or light petroleum mixed with a trace of *p*-methoxytetrahydroquinoline (thallin base) is shaken with two volumes of nitric acid of sp. gr. 1.4. The acid assumes the colour of methyl-violet, which disappears on dilution. A similar reaction is obtained with toluene containing methylthiophen. Most benzenes contain thiophen, which may be removed by treatment with sulphuric acid. L. DE K.

**Iodometry of Ferro- and Ferri-cyanides.** By ERWIN RUPP and ALBERT SCHIEDT (*Ber.*, 1902, 35, 2430—2434).—In order to replace de Haën's inexact method of estimating potassium ferrocyanide by means of standard permanganate, the quantitative conversion of ferrocyanide into ferricyanide by adding excess of a standard iodine solution and then titrating the excess of iodine by thiosulphate was tried; when the oxidation is carried out in the presence of sodium hydrogen carbonate, the method gives excellent results if the mixture of iodine and ferrocyanide is left for 15 minutes. In the presence of acetic acid, the oxidation only becomes complete when the mixture is warmed. With mineral acids, hydrogen iodide reduces ferricyanides. The authors have compared their method with Kistia-kowsky's (*J. Russ. Phys. Chem. Soc.*, 1897, 29, 362), namely, titration with silver nitrate and potassium chromate as indicator, and have found that the results of both methods are in very good agreement. Potassium ferricyanide can be accurately estimated by reduction by means of ferrous sulphate to ferrocyanide and subsequent titration

of the latter by the above method ; hydrogen peroxide can also be used to reduce the ferrieyanide, but the excess of the peroxide must be removed by boiling before the iodine is added. K. J. P. O.

**Estimation of Glycerol by means of Iodic Acid in presence of Sulphuric Acid.** By A. CHAUMEIL (*Bull. Soc. Chim.*, 1902, [iii], 27, 629—634).—For the purpose of estimating glycerol, the author employs iodic acid in presence of sulphuric acid, whereby iodine is liberated quantitatively and can be titrated with sodium thiosulphate. When the solution contains chlorides, which would be capable of interacting with the iodic acid, the chloride present is first determined by titration, and the corresponding amount of thiosulphate subtracted from the total amount used. A. F.

**Volumetric Estimation of Thymol.** By EMIL ZDAREK (*Zeit. anal. Chem.*, 1902, 41, 227—231).—A process similar to that of Koppeschaar for titrating phenol gives good results with thymol. The weighed substance is treated in a stoppered bottle with an excess of a standard bromide-bromate solution and hydrochloric acid. After shaking for five minutes, potassium iodide is added and the liberated iodine is titrated with thiosulphate. A return of the iodine-starch blue colour shortly takes place, but should be neglected. Under these conditions, the molecule of thymol consumes four atoms of bromine, but the tetrabromothymol is very unstable and could not be prepared in the dry state. The presence of alcohol does not affect the accuracy of the method. M. J. S.

**Reaction for Distinguishing  $\alpha$ -Naphthol from  $\beta$ -Naphthol.** By ARMAND JORISSEN (*Ann. Chim. anal.*, 1902, 7, 217—219).—A pinch of the sample is mixed in a test-tube with 2 c.c. of a solution of iodine in potassium iodide and then with excess of aqueous sodium hydroxide. On shaking the mixture,  $\beta$ -naphthol gives a clear, colourless liquid, but  $\alpha$ -naphthol yields a turbid solution of intense violet colour. Mixtures also give a more or less coloured solution. L. DE K.

**Estimation of Lactose in Milk.** By GUSTAVE PATEIN (*J. Pharm. Chim.*, 1902, [vi], 15, 505—509).—The variable results obtained in the estimation of lactose in milk are due to incomplete precipitation of proteids by such precipitants as the normal and basic acetates of lead. The acid solution of mercuric nitrate used by Patein and Dufau (*Abstr.*, 1902, ii, 291) is recommended for this purpose ; the preparations so obtained can afterwards be used for check volumetric estimations of the lactose with Fehling's solution. T. A. H.

**Estimation of Sucrose in Preserved Fruits containing Starch Sugar.** By O. SCHREFELD (*Zeit. Ver. Deut. Zuckerind.*, 1902, 554, 204—206).—The official German method of estimating the proportion of sucrose in preserved fruits consists essentially in preparing a cold water extract of the fruit and weighing the amounts of copper reduced from Fehling's solution by this extract both before

and after inversion with hydrochloric acid. The amount of invert sugar corresponding with the difference between these two weights of copper is then ascertained by means of Wein's tables, and from this the sucrose present can be calculated. This method assumes that the reducing power of the inverted sucrose is not influenced by the presence of the starch sugar, but the author's experiments here described show that this is by no means the case. Since the proportion of dextrin in starch sugar varies widely, it is not possible to allow for its influence on the copper reduction by means of a formula. It is therefore recommended in such analyses to employ the optical inversion method, which should also be used for detecting the presence of starch sugar in sucrose.

T. H. P.

**Polarisation of Fruits, Jellies, Jams, and Honeys.** By L. M. TOLMAN (*J. Amer. Chem. Soc.*, 1902, 24, 515—524).—Hydrochloric acid increases the laevorotation of an invert sugar solution; the increase, other things being equal, is proportional to the quantity of acid used. Other things being equal and temperature varying, hydrochloric acid increases laevorotation by a definite percentage of the polarisation. In order to get a trustworthy result when using Clerget's formula for the calculation of the amount of sucrose in invert sugar, a correction should be made depending on the amount of hydrochloric acid present. On this point, reference should be made to the graphic representations in the original paper. All readings of the polariscope should be made at or about 20°.

L. DE K.

**Application of the Pentosan Process to Various Vegetable Matters and Materials used in the Manufacture of Paper.** By E. KRÖBER and CHARLES RIMBACH (*Zeit. angew. Chem.*, 1902, 15, 508—510).—Tables giving the amount of pentosan contained in a variety of substances as estimated by distillation with hydrochloric acid and treatment of the distillate with phloroglucinol. The following substances have been experimented with: sugar, potato-starch, Swedish filter paper, wadding, cotton-wool (none of these contains appreciable quantities of pentosan); various wood-gums (xylan); crude fibres from different materials prepared in different ways; various specimens of wood; fossil woods, lignite, coal (the latter yields no trace); various vegetable tissues including leaves, stems, roots, &c., the materials used in paper making, and also the finished article.

Provided the origin of the paper is known, its quantitative analysis is much assisted by a pentosan estimation owing to the great difference in pentosan yielded by the various constituents.

L. DE K.

**Estimation of Pentoses and Pentosans by means of Distillation with Hydrochloric Acid and Precipitation of the Furfuraldehyde with Phloroglucinol.** By E. KRÖBER and CHARLES RIMBACH (*Zeit. angew. Chem.*, 1902, 15, 477—482).—The authors have further improved this well-known process. To obtain correct results, the weight of the phloroglucide (dried at 98°) should be increased by

0.0052 gram, this being the amount retained by the 550 c.c. of mother liquor and washings.

Tables are given for the calculation of the weight of the precipitate into furfuraldehyde, arabinose, araban, xylose, xylan, pentoses, or pentosans.

L. DE K.

**Estimation of Hydrocyanic Acid.** By ANDREA ARCHETTI (*Chem. Zeit.*, 1902, 26, 555).—A definite volume of the sample is shaken with a weighed quantity ( $P$ ) of mercurous chloride, which then forms mercuric cyanide, hydrogen chloride, and free mercury; 1 mol. of mercurous chloride represents 2 mols. of hydrocyanic acid.

The undissolved mercurous chloride ( $p$ ) is collected on a filter and freed from the admixed mercury by washing with a mixture of 1 vol. of nitric acid of sp. gr. 1.40 and  $\frac{1}{2}$  volume of water. After it has been weighed, the amount of hydrocyanic acid is found by means of the formula ( $P - p$ ) 56/47.

L. DE K.

**Iodometry of Thiocyanic Acid.** By ERWIN RUPP and ALBERT SCHIEDT (*Ber.*, 1902, 35, 2191—2195).—It is found that thiocyanic acid (and thiocyanates) can be accurately estimated by adding excess of  $N/10$  iodine solution to a dilute solution of a thiocyanate containing sodium hydrogen carbonate; after keeping for half-an-hour, the excess of iodine is titrated by means of  $N/10$  thiosulphate. The results show that 8 atoms of iodine are equivalent to 1 mol. of thiocyanic acid; the reaction is therefore expressed by the equation  $\text{KCNS} + 4\text{I}_2 + 4\text{H}_2\text{O} = \text{H}_2\text{SO}_4 + 6\text{HI} + \text{KI} + \text{ICN}$ . Since cyanogen iodide affects starch solution, the latter cannot be used as an indicator in titrating the excess of iodine; the disappearance of colour is depended on.

The estimation of a mixture of chloride and thiocyanate is effected by determining the total chloride and thiocyanate with silver nitrate by Volhard's process, and then titrating the thiocyanate with iodine. In the case of a mixture of cyanide and thiocyanate, the total is estimated by Volhard's method and the thiocyanate by iodine after the hydrocyanic acid has been removed by boiling the mixture with tartaric acid for 15—20 min. In a similar manner, a mixture of chloride, cyanide, and thiocyanate can be accurately analysed.

K. J. P. O.

**Estimation of Methyl Anthranilate in Ethereal Oils.** By ALBERT HESSE and OTTO ZIETSCHER (*Ber.*, 1902, 35, 2355—2347. Compare Abstr., 1901, ii, 209, and Erdmann, this vol., ii, 292).—A comparison of the authors' method of estimating methyl anthranilate with that proposed by Erdmann. The latter process, although applicable to the pure ester, does not lend itself to the estimation of this compound in a complex mixture, the results being always too low. As indicated by the authors, it is preferable to first separate the ester by the action of sulphuric acid in ethereal solution.

Erdmann's method might, however, be employed with advantage in estimating the ester in the presence of methyl methylsalicylate, for both the ethereal salts would be precipitated together by the action of sulphuric acid.

G. T. M.



**Determination of the Iodine Number.** By MORITZ KITT (*Chem. Zeit.*, 1902, 26, 554).—The author's process for preparing the Hübl solution (Abstr., 1901, ii, 587) has been found to answer in practice.

L. DE K.

**Estimation of Arachis Oil.** By MASSIMO TORTELLI and R. RUGGERI (*Chem. Centr.*, 1902, i, 833; from *Mon. sci.*, [iv], 16, 215—217. Compare Abstr., 1898, ii, 653).—According to Archbutt (Abstr., 1899, ii, 269), the melting point of the mixture of arachic and lignoceric acids obtained from pure arachis oil is between 71° and 72·5°, whilst the authors had previously found it to be 74—75·5°. The discrepancy is probably due to the method used. Archbutt's method of partial precipitation of the soap with lead acetate, instead of using an excess, is according to the authors not so trustworthy as their own process.

L. DE K.

**Detection of Heated Milk.** By DU ROI and KÖHLER (*Milch-Zeit.*, 1902, 31, 17—18, 113).—Fifty c.c. of the milk are shaken with 1 c.c. of a 1 per cent. solution of hydrogen peroxide and 3 c.c. of the mixture then poured into a test-tube containing 3 c.c. of a solution of potassium iodide and starch. Should the milk be raw, a blue colour appears on thoroughly agitating the contents of the tube, whilst in the case of heated milk the mixture remains colourless. Heating the milk to 80° is sufficient to prevent the colour being formed. Small quantities of potassium dichromate or formaldehyde do not interfere with the reaction. Two per cent. of raw milk in heated milk can be detected by the test.

B. STORCH (*ibid.*, 81—82) prefers the use of a 2 per cent. aqueous solution of *p*-phenylenediamine instead of starch and potassium iodide, as the latter is liable to decomposition on keeping. He also uses a 0·2 per cent. solution of hydrogen peroxide.

FRANZ UTZ (*ibid.*, 145—146) mentions that the solution of hydrogen peroxide as used in the method described by du Roi and Köhler should not be stronger than 0·1 per cent. More concentrated solutions sometimes give a blue colour with starch and potassium iodide.

W. P. S.

**Detection of Heated Milk by Means of the Guaiacum Test.** By CARL ARNOLD and CURT MENTZEL (*Milch-Zeit.*, 1902, 31, 247).—When a 10 per cent. solution of guaiacum resin in acetone is allowed to run on to the surface of unheated milk, a blue zone appears at the junction of the two liquids. Boiled milk containing 12·5 per cent. of raw milk gives the blue coloration within 5 minutes, whilst boiled milk alone yields no colour, even after long standing. Acetone was found to be the best solvent for the guaiacum resin.

W. P. S.

**Use of the Refractometer in Milk Analysis.** By FRANZ UTZ (*Milch-Zeit.*, 1902, 31, 49—50).—The milk is allowed to curdle spontaneously at a temperature of 37·5° and filtered. The clear whey is then cooled to 15° and the refractive index taken. Genuine milk gave

numbers from 1·3431 to 1·3442, and when diluted with various quantities of water, the following numbers were obtained :

Added water.	Refraction at 15°.	Added water.	Refraction at 15°.
5 per cent.	1·3425—1·3430	33·3 per cent.	1·3401
10    ,,	1·3418—1·3425	40    ,,	1·3390—1·3393
20    ,,	1·3411—1·3412	50    ,,	1·3384—1·3388
25    ,,	1·3405	60    ,,	1·3373
30    ,,	1·3394—1·3403	Water alone	1·3373

The lactic acid in the whey has a very slight influence on the refractive index.

W. P. S.

**Decrease in the Acidity of Milk.** By ARTHUR KIRSTEN (*Milch-Zeit.*, 1902, 31, 114—118).—The acidity of milk is stated to decrease when the milk is kept in open vessels and also when it is boiled or subjected to centrifugal action. This decrease is due to a loss of dissolved carbon dioxide. Carbon dioxide also accounts for a part of the acidity of fresh milk. The period of time during which the acidity of milk remains constant, termed the "incubation stage" by Soxhlet, should be considered, in the light of the author's experiments, as the time in which the lactic acid bacteria produce only so much lactic acid as is balanced by the loss of free carbon dioxide.

W. P. S.

**Presence of Nitrates in Milk as an Indication of Adulteration.** By NICLAUS GERBER and P. WIESKE (*Milch-Zeit.*, 1902, 31, 82—84).—Nitrates may be tested for in milk by allowing a small quantity of the latter to run on to the surface of an equal volume of sulphuric acid containing a little formaldehyde. A blue or violet ring is formed, in the presence of nitrates, at the junction of the two liquids. As milk does not naturally contain any nitrates, the above test is of some use for detecting the addition of water to the milk, although most town water supplies are so free from nitrates that the test only occasionally yields positive results.

W. P. S.

**Detection of Artificial Colouring Matters in Fresh and Sour Milk.** By M. WYNTER BLYTH (*Analyst*, 1902, 27, 146—151).—The action of decomposing milk on coal-tar dyes is the same as is the action of zinc dust and hydrochloric acid. The colour is destroyed and, although in some cases it may be restored by shaking with air, in others no re-appearance of the colour takes place. For the certain detection of added colouring matter, the following method is proposed. The milk is rendered faintly alkaline to litmus paper, evaporated to a paste, and thoroughly extracted with ether. The ethereal solution is evaporated to dryness, the residue of fat is extracted with water, and the residue obtained on the evaporation of the aqueous portion is tested for colouring matters. The fat-free milk residue is then exhausted with absolute alcohol, filtered, and separate portions of the alcoholic liquid evaporated in china basins. To the residues obtained, the usual tests may be applied. For instance, the sulphonated azo-dyes are recognised by the colour produced on adding

sulphuric acid; the natural colouring matters and non-sulphonated acid coal-tar dyes are soluble in ether, whilst the basic colours and sulphonated dyes are insoluble in this medium. W. P. S.

**Abnormal Milk.** By JULES WAUTERS (*Rev. intern. Falsific.*, 1902, 15, 67—69).—The milk from two cows in a herd of ten was found to be of very abnormal quality. One milk yielded from 1.319—2.575 per cent. of fat, 4.116—6.760 per cent. of casein and lactose, and 5.031—7.635 per cent. of non-fatty solids. The milk of the second cow gave 1.250—2.965 per cent. of fat, 5.190—7.110 per cent. of casein and lactose, and 6.190—8.085 per cent. of non-fatty solids. The ash of the milks was abnormally high. W. P. S.

**Estimation of the Soluble Acids in Butter.** By L. VANDAM (*Rev. intern. Falsific.*, 1902, 15, 61—65).—An estimation of the soluble acids in butter is stated to give more trustworthy indications of adulteration than are given by the Reichert-Wollny figure. Tables are given showing that the amount of soluble acids in some cases plainly pointed to adulteration, whilst the Reichert-Wollny figure was not unusually low. The estimation is particularly useful should cocoa-nut oil be present in the sample. W. P. S.

**Estimation of Glycine.** By EMIL FISCHER (*Zeit. physiol. Chem.*, 1902, 35, 229—230).—The author finds that glycine may be satisfactorily estimated by saturating at 0° with hydrogen chloride a solution of this amino-acid in absolute alcohol, thereby converting it into the hydrochloride of glycine ethyl ester, which separates, after standing at 0° for 12 hours, to the extent of 95 per cent. In presence of other amino-acids, the yield is less satisfactory (compare Fischer and Skita, *Abstr.*, 1901, i, 783). T. A. H.

**Estimation of Urea in Urine.** By CH. SALLERIN (*Bull. Soc. Chim.*, 1902, [iii], 27, 620—625).—The author has compared the methods of Mörner and Sjöqvist, of Salaskin and Zaleski, and of Braunstein (*Abstr.*, 1901, ii, 140) for the estimation of urea in urine, and finds that the method last mentioned is the best. For the complete hydrolysis of the urea, the author finds that it is necessary to heat the solution with phosphoric acid for seven hours at 150—155°. A. F.

**Jolles' Method of estimating Uric Acid.** By GABRIEL MÁTRAI (*Zeit. physiol. Chem.*, 1902, 35, 205—209).—Trustworthy results were not obtained in estimations of uric acid by the method described by Jolles. W. D. H.

**Estimation of Uric Acid in Urine.** By JULIUS RUDISCH and LEOPOLD BOROSCHEK (*J. Amer. Chem. Soc.*, 1902, 24, 562—569).—A modification of the silver method. One hundred c.c. of the sample are neutralised with a saturated solution of sodium carbonate, and 15 c.c. extra of this are then added. Ten c.c. of *N*/20 solution of silver chloride in saturated solution of sodium sulphite are added, and after standing

for an hour the precipitate is collected and washed with a dilute solution of sodium carbonate. The silver in the precipitate is then determined by the thiocyanate method. One atom of silver equals one molecule of uric acid. Small quantities of xanthine bases, which are also precipitated, may be allowed for by applying the principle of Salkowski's method (*Pflüger's Archiv*, 1898, 69, 280). L. DE K.

**Fractional Oxidation with the Aid of Indicators and its Application to the Estimation of Xanthine Derivatives in Urine.** By LADISLAUS NIEMIŁOWICZ (*Zeit. physiol. Chem.*, 1902, 35, 264—297).—When a solution of potassium permanganate is added to a liquid containing a series of substances of different stabilities towards this reagent, it is possible in certain cases to ensure the destruction of the least stable compound without losing more than traces of the most stable one. The point at which this occurs may be ascertained by titrating in presence of a coloured indicator, the stability of which towards permanganate is intermediate between those of the extreme members of the series present, and is also expressible in terms of permanganate necessary for its decolorisation. The author has devised two processes for the estimation of xanthine derivatives in urine involving the destruction of uric acid and the conservation of the xanthine compounds based on the principle already mentioned. To 100 c.c. of the sample, acidified by hydrochloric acid if necessary, 0.005 gram of indigo-carmin, dissolved in 1 c.c. of water, is added and the mixture titrated with permanganate until the green colour is just destroyed; this addition of indigo-carmin to the same sample and titration with permanganate is repeated until two consecutive titrations differ by not more than 0.1 c.c. (usually three titrations are necessary). At this point, the uric acid has been destroyed, but the xanthine compounds remain unattacked and may be estimated by the process devised by Denigès (*Abstr.*, ii, 1894, 403) or by that of Haycraft (*Abstr.*, 1886, 748). T. A. H.

**Error in the Estimation of Xanthouric compounds caused by certain Foods and Medicaments.** By GUSTAVE ANDRÉ (*J. Pharm. Chim.*, 1902, [vi], 15, 522—527).—The consumption of tea, coffee, and chocolate, or the employment of xanthine derivatives as medicinal agents, leads to an increased excretion in the urine of xanthouric compounds, which, by the usual analytical methods are calculated entirely as uric acid, and so give results of doubtful clinical value. T. A. H.

**Extraction of Alkaloids from Acid Solutions and of Alkaloid Salts from Aqueous Solutions.** By EDMUND SPRINGER (*Chem. Centr.*, 1902, i, 1064—1065; from *Apoth.-Zeit.*, 17, 225—226. Compare this vol., 390).—From the results of experiments on the extraction of alkaloids from acid solutions by treatment with chloroform in Gadamer's apparatus ("perforator") for half-an-hour, the following conclusions are drawn. Morphine, coniine, and nicotine are not extracted by the chloroform. Aconitine, strychnine, narcotine, quinine, and veratrine are extracted in considerable quantities in pre-



sence of hydrochloric acid of sp. gr. 1.12 and narcotine is also dissolved by chloroform in presence of sulphuric acid of sp. gr. 1.11. Traces of almost all the other alkaloids are removed from solutions containing hydrochloric acid or dilute sulphuric acid. Chloroform extracts considerable amounts of aconitine and narcotine, but only extremely small quantities of atropine and veratrine from solutions containing tartaric acid, whilst codeine, cocaine, and quinine do not dissolve under these conditions.

Phosphoric acid of sp. gr. 1.154, affects the behaviour of alkaloids to chloroform in the same way as sulphuric acid of sp. gr. 1.11, and, similarly, citric and oxalic acids resemble tartaric acid in this respect. In toxicological examinations, the presence of hydrochloric acid or of chlorides is therefore to be avoided; sulphuric and phosphoric acids are less harmful, but oxalic, citric, and tartaric acids may be more advantageously employed. The extraction of alkaloids is more complete in weak than in strong acid solutions, and is aided by the presence of large quantities of salts, but it is not affected by the presence of saponin, glycerol, &c. Morphine hydrochloride and sulphate and quinine sulphate are not removed from aqueous solutions by chloroform, but traces of cocaine are extracted from aqueous solutions of its hydrochloride; other alkaloids are dissolved in considerable quantities partly as free base and partly as salt.

E. W. W.

**Limits of Sensitiveness of Alkaloidal Precipitants.** By EDMUND SPRINGER (*Chem. Centr.*, 1902, i, 1027; from *Apoth.-Zeit.*, 17, 201—202).—Salts of the alkaloids are more readily precipitated from a dilute solution than are the alkaloids themselves. The most delicate precipitants are phosphomolybdic acid and potassium bismuthiodide.

L. DE K.

**Microchemical Detection of Some Alkaloids.** By SURRE (*Bull. Soc. Chim.*, 1902, [iii], 27, 626—629).—The solution containing the alkaloid is placed on a watch-glass, and to it are added a drop of the particular reagent and a few drops of absolute alcohol; the crystals formed are then examined under the microscope. The following results have been obtained:—With Mayer's reagent: strychnine: slender needles, single or grouped, in the form of X or Y; with polarised light, they show a faint bluish tinge. Codeine: small tufts of crystals of a bright silver-white colour with polarised light. With Bouchardat's reagent: Brucine: crystals in the form of plumes; with artificial polarised light, bright yellow, blue, and red. Atropine: short, thick, dark brown crystals; with polarised light, dark orange-coloured. Hyoscyamine: crystals closely resembling those of atropine. With Marmé's reagent: Morphine: long, silky, thread-like crystals. Papaverine: very short crystals grouped in large numbers round a common point; with polarised light, whitish pink. Sparteine: fern-like crystals growing from a common axis. The following alkaloids do not crystallise under the foregoing conditions: narcotine, narceine, thebaine, quinine, quinidine, veratrine, cinchonine, cinchonidine, hyoscyne, aconitine, cocaine, nicotine, cicutine, caffeine, theobromine,

pilocarpine, curarine, and some others. The above method cannot be employed in the presence of ptomaines. A. F.

**Estimation of Indigotin in Fabrics.** By A. BINZ and F. RUNG (*Zeit. angew. Chem.*, 1902, 15, 557—559).—The authors state that both commercially pure and chemically pure indigotin suffer a slight decomposition when boiled with glacial acetic acid in the presence of woolly substances. This does not, however, interfere with the use of glacial acetic acid as a solvent when making comparative analytical experiments with fabrics containing indigo. L. DE K.

**Reaction for Santonin in Urine.** By ED. CROUZEL (*Ann. Chim. anal.*, 1902, 7, 219—220).—It is known that urine from a person to whom santonin has been administered turns red on adding alkalis or ammonia. The author states that the test is rendered more delicate by using calcium hydroxide, or better still, calcium carbide.

The test does not work with urine in which santonin has been simply dissolved, but only when this has been taken internally. The urine turns a deep yellow, milky colour, and the test may be obtained even 60 hours after taking a dose of santonin. The reaction may probably be useful in the study of kidney diseases. L. DE K.

**Colour Reactions of Red Blood-corpuscles in Diabetes.** By J. LE GOFF (*Compt. rend.*, 1902, 134, 1119—1120).—If a film of normal blood is treated with a mixture of eosin and methylene-blue, the red corpuscles are stained with the eosin; if the blood is diabetic, they take up the methylene-blue. After removal of the hæmoglobin, these differences do not obtain. Normal blood mixed with dextrose, lævulose, xylose (but not with sucrose), aldehyde, or acetone, shows the same affinity of the red corpuscles for basic dyes. W. D. H.

NOTE.—The main fact described above is not a new discovery; it is usually described as Williamson's reaction. W. D. H.

**Volumetric Estimation of Sodium Methylarsenate.** By ELIE FALIÈRES (*J. Pharm. Chim.*, 1902, [vi], 15, 466—469).—Although silver methylarsenate,  $\text{CH}_3\cdot\text{AsO}_3\text{Ag}_2$ , is slightly soluble in water, it becomes practically insoluble in presence of excess of silver nitrate. For the purpose of estimating sodium methylarsenate,  $\text{CH}_3\cdot\text{AsO}_3\text{Na}_2\cdot 6\text{H}_2\text{O}$ , the solution of this salt is treated with a known excess of silver nitrate, the solution filtered from the insoluble silver methylarsenate and the filtrate titrated with a standardised solution of sodium chloride. A. F.

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## General and Physical Chemistry.

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**Comparative Study of the Spectra, Densities, and Melting Points of some Groups of Elements, and of the Relation of Properties to Atomic Mass.** By HUGH RAMAGE (*Proc. Roy. Soc.*, 1902, 70, 1—27).—The author arrives at the following conclusions. The properties of the elements are fundamentally due to the structure of the atoms as revealed by their spectra rather than to the quantity of matter in them. Considering that the strontium molecule must have a similar structure to the calcium molecule, it is inconceivable that, in the genesis of the elements, the transition from calcium to strontium proceeded through the intermediate elements. In the case of the elements tellurium and iodine, with neighbouring atomic weights, the genesis was not from tellurium to iodine, but from or through oxygen and fluorine respectively. It is probable that in the genesis of the elements the properties of certain fundamental substances are modified by successive additions of matter, or by causes of which this is the apparent result. The regularity in the changes in the properties of lithium, beryllium, boron, and carbon, as shown by the diagrams communicated, is very remarkable and suggestive, for the changes in properties are approximately proportional to the quantity of matter in the atom in excess of a constant (about 6), as if it were the same matter that is added in each case.

J. C. P.

**Chemical Dynamics and Statics under the Action of Light.** By MEYER WILDERMAN (*Proc. Roy. Soc.*, 1902, 70, 66—74).—With the object of elucidating the laws that govern chemical equilibrium in light, the author has studied the progress of the reaction  $\text{CO} + \text{Cl}_2 = \text{COCl}_2$ . The extent to which carbon monoxide and chlorine have united can easily be determined, because the reaction is accompanied by a gradual change of volume. To secure a powerful light of steady composition, acetylene was used, and with the help of a thermopile and galvanometer the intensity could be adjusted to about 0.1 per cent. As the slightest traces of air or water-vapour markedly retard or accelerate the combination of carbon monoxide and chlorine, the greatest care had to be taken in the preparation of these gases. The velocity of combination of carbon monoxide and chlorine is found to be adequately represented by the differential equation  $dx/dt = K(A-x)(B-x)$ , where  $A$  and  $B$  are the initial quantities of carbon monoxide and chlorine, measured by their partial pressures,  $A-x$  and  $B-x$  are the quantities present after time  $t$ , and  $K$  is a constant for light of a given wave-length and steady intensity. In discussing evidence from the above and similar cases of chemical reaction in homogeneous systems, the author concludes that chemical equilibrium in homogeneous systems is regulated, in the light as well as in the dark, by the laws of mass action. The author deals also with the phenomena of chemical induction and deduction, as well as with induction and deduction periods of energy.

J. C. P.

**Conditions Determinative of Chemical Change and of Electrical Conduction in Gases, and on the Phenomena of Luminosity.** By HENRY E. ARMSTRONG (*Proc. Roy. Soc.*, 1902, 70, 99—109).—The author regards Brereton Baker's recent work as confirmatory of his own view that the presence of an electrolyte is a necessary condition for the occurrence of chemical action, and that pure gases should be perfect dielectrics (see Armstrong, *Proc.*, 1893, 145, and *Trans.*, 1895, 1141).

The problem of electrical discharge in gases has not yet been attacked with the same accurate methods as have been applied by Dixon, Brereton Baker, and Shenstone in the case of chemical change, and the author contends that there is evidence that the discharge in a vacuum tube is conditioned by the presence of impurities (from soft glass, sulphuric acid, and commercial phosphoric oxide).

In the case of the luminosity of the rare earths, the incandescence of oxides generally, and the phenomena of phosphorescence under the influence of the electric discharge, it is argued that the process in each case may be one of recurrent oxidation or polymerisation. The argument is extended to the case of emanations from radioactive substances, and to that of the 'so-called' ionisation of air.

J. C. P.

**Researches on Elements founded on the Reciprocal Action of Two Liquids.** By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1902, 134, 1461—1478. Compare this vol., ii, 375, 376).—The amount of hydrogen evolved per minute in a voltameter when a current was passed through it was measured. In the circuit of the current, a known metallic resistance was interposed. Using two Daniell cells and with the voltameter under the ordinary atmospheric pressure, there is no visible evolution of gas when there is a resistance of 5000 ohms in the circuit. If the resistance is reduced to 2000 ohms, the gas evolution commences, and 0.000187 mg. of hydrogen is evolved per minute. At 1000 ohms, the quantity of hydrogen is 0.00037 mg. The pressure in the voltameter was reduced to 5 mm., and the gas evolution then becomes apparent when the resistance is 25,000 ohms. At 20,000 ohms, the hydrogen evolved per minute amounts to 0.000018 mg.

The evolution of gas is produced with a smaller *E.M.F.* if the voltameter contains a substance, such as pyrogallol, capable of absorbing oxygen—a fact which is probably due to the diminution of polarisation.

Using two Daniell cells and with pyrogallol in the voltameter, the evolution of gas is apparent when there is a resistance of 20,000 ohms in the circuit, and 0.000044 mg. of hydrogen is evolved per minute. With 10,000 ohms, the quantity of hydrogen amounts to 0.000087 mg. Employing a single Daniell cell and with the pressure in the voltameter (containing pyrogallol) reduced to 5 mm., the evolution becomes apparent when the circuit contains a resistance of 90,000 ohms. From these numbers, it is evident that the presence of pyrogallol exercises a profound influence on the evolution of gas in the voltameter.

A number of cells previously examined (*loc. cit.*) have been re



investigated. It is now found that the *E.M.F.* varies slightly with time, showing at first a slight increase, and different cells of the same composition give a slightly different *E.M.F.* After resting for some time, however, the cell gives an approximately constant *E.M.F.* These deviations are attributed to the state of humidity of the atmosphere, which interferes with the insulation.

With a battery of six elements composed of 0.2*N* sulphuric acid and 0.2*N* sodium hydroxide in porous vessels, the *E.M.F.* immediately after setting up was 2.94 volts. After the circuit with an external resistance of 4000 ohms had been closed for 4 minutes, the *E.M.F.* fell to 1.98 volts. The circuit was then broken for 15 minutes; the *E.M.F.* again rose to 2.58 volts, and after being closed for 4 minutes it decreased to 1.56 volts. After 7 minutes, the circuit being open, the *E.M.F.* had risen to 1.92 volts, and at the end of an hour to 2.46 volts. Closing the circuit for 7 minutes caused the *E.M.F.* to sink to 1.68 volts, and then opening it for 1 minute brought about a rise to 1.74 volts. By this time, the titre of the sodium hydroxide had decreased by 7 per cent. Thirty-six hours after setting the apparatus together, it was found that the alkali was completely neutralised and no current could be obtained. The same solutions have been examined when contained in separate vessels connected by a syphon; similar results have been obtained. Also with others of the solutions previously studied, analogous results have been found. These results prove that the elements examined are capable of yielding a continuous current.

The number of elements required to give a visible evolution of gas in the voltameter can be ascertained from the formula

$$i = (N - 1.6) / (2.10N\epsilon/n - R),$$

where *i* is the intensity expressed in amperes,  $\epsilon$  the *E.M.F.* of one element, *N* $\epsilon$  that of *N* elements in series, *n* the number of scale-divisions over which the galvanometer needle moves, and *R* the external resistance. The values calculated from this formula agree well with the results previously found.

J. McC.

Evident Electrolytic Actions developed by Elements constituted by the Reactions between Two Liquids, one containing an Acid, the other an Alkali. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1902, 135, 129—133).—It is shown that an element consisting of an acid and an alkali in porous vessels is capable of giving a definite *E.M.F.* The current developed is continuous, and with 6 elements containing hydrochloric acid and sodium hydroxide 2.4 volts can be obtained. With the aid of these elements, acidified water can be electrolysed, and if pyrogallol be added the evolution of gas is evident, particularly if the voltameter be under reduced pressure.

J. McC.

Correction of Observed Values of Specific Heats and Heats of Vaporisation of Organic Compounds of High Boiling Point. By WLADIMIR F. LUGININ (*Ann. Chim. Phys.*, 1902, [vii], 26, 228—247. Compare Abstr., 1899, ii, 269, and 1901, ii, 145).—By means of an improved form of apparatus described in the *J. de Physique* (1901, [iii], 10, 5), the author has obtained exact

values of the specific heats and heats of vaporisation of the following organic substances :

	Latent heat of vaporisation.	Specific heat.	Temperature interval.
Methyl hexyl ketone.....	71.11	0.5723	172° - 23°
Ethylene glycol .....	190.90	0.6808	195 - 20
Benzyl alcohol .....	98.46	0.5579	200 - 22
Benzaldehyde .....	86.55	0.4453	172 - 22
Diethyl oxalate .....	67.58	0.4818	180 - 21

The application of Trouton's law,  $MS/T = K$ , to these data shows that diethyl oxalate, benzaldehyde, and methyl hexyl ketone do not exhibit polymerism in the liquid state, whilst the presence of polymeric molecules is distinctly noticeable in the case of ethylene glycol, but only just appreciable in that of benzyl alcohol.

G. T. M.

**Specific Heats and Heat of Vaporisation of the Paraffin and Methylene [*cyclo*Paraffin] Hydrocarbons.** By CHARLES F. MABERY and ALBERT H. GOLDSTEIN (*Amer. Chem. J.*, 1902, 28, 66—78).—The specific heats of a number of hydrocarbons of the paraffin and *cyclo*-paraffin series were determined by means of a Bunsen ice calorimeter. The following results were obtained :

Hydrocarbon.	C <sub>6</sub> H <sub>14</sub> .	C <sub>7</sub> H <sub>16</sub> .	C <sub>7</sub> H <sub>16</sub> .	C <sub>8</sub> H <sub>18</sub> .	C <sub>9</sub> H <sub>20</sub> .	C <sub>10</sub> H <sub>22</sub> .	C <sub>10</sub> H <sub>22</sub> .	C <sub>11</sub> H <sub>24</sub> .
Boiling point	68°	91°	98°	125°	151°	162°	172°	195°
Specific heat.	0.5272	0.5005	0.5074	0.5052	0.5034	0.4951	0.5021	0.5013
K.....	2.26	—	2.21	2.21	2.22	—	2.23	2.23

Hydrocarbon.	C <sub>12</sub> H <sub>26</sub> .	C <sub>13</sub> H <sub>28</sub> .	C <sub>14</sub> H <sub>30</sub> .	C <sub>15</sub> H <sub>32</sub> .	C <sub>16</sub> H <sub>34</sub> .	Com- mercial gasoline.	Crude Ohio petroleum.
Boiling point	214°	226°	242°	260°	275°	—	—
Specific heat.	0.4997	0.4986	0.4973	0.4966	0.4957	0.5135	0.4951
K.....	2.23	2.24	2.23	2.24	2.23	—	—

Hydro- carbon.	C <sub>6</sub> H <sub>12</sub> .	C <sub>7</sub> H <sub>14</sub> .	C <sub>8</sub> H <sub>16</sub> .	C <sub>9</sub> H <sub>18</sub> .	C <sub>10</sub> H <sub>20</sub> .	C <sub>11</sub> H <sub>22</sub> .	C <sub>12</sub> H <sub>24</sub> .	C <sub>13</sub> H <sub>26</sub> .	C <sub>14</sub> H <sub>28</sub> .	C <sub>15</sub> H <sub>30</sub> .
Boiling point.	68°	98°	119°	135°	160°	190°	212°	232°	244°	263°
Specific heat.	0.5062	0.4879	0.4863	0.4851	0.4692	0.4819	0.4570	0.4573	0.4531	0.4708
K .....	2.26	2.28	2.37	2.27	—	2.25	—	—	—	2.20

These results show that there is a uniform decrease in specific heat with increase in molecular weight, and also that the normal hydrocarbons, such as heptane (b. p. 98°) and decane (b. p. 172°) have higher specific heats than their isomerides, such as *iso*heptane (b. p. 91°) and *isodecane* (b. p. 162°). The constant K (sp. heat × mol. weight/number of atoms in molecule) for the paraffin series is 2.23, whilst in the case of the *cyclo*paraffin hydrocarbons the mean value is seen to be somewhat higher.

The specific heats of a series of hydrocarbons separated from the high-boiling portion of Pennsylvania petroleum gave the following values :

Hydrocarbon.	$C_{16}H_{32}$ .	$C_{18}H_{36}$ .	$C_{20}H_{40}$ .	$C_{22}H_{44}$ .	$C_{24}H_{48}$ .
Boiling point .....	173°	202°	223°	260°	272°
Specific heat .....	0·4723	0·4723	0·4706	0·4612	0·4586

The following are the specific heats of hydrocarbons separated from Texas petroleum :

Hydrocarbon.	$C_{14}H_{26}$ .	$C_{15}H_{28}$ .	$C_{16}H_{30}$ .	$C_{21}H_{38}$ .	$C_{25}H_{46}$ .
Boiling point under 50 mm. ...	127°	142°	162°	218°	273°
Specific heat .....	0·4447	0·4439	0·4426	0·4560	0·4650
K.....	2·15	2·15	2·14	—	—

The two last results are not trustworthy, since the quantities of the hydrocarbons were very small and the oils begin to crystallise at 0°.

The specific heat was also determined in the following crude oils from various fields; the results indicate that the specific heat of crude oils is an important property from a practical point of view :

	Pennsyl- Oil.	Berea vania.	Japan- grit.	Texas (Lucas ese. well).	Rus- sian.	Wyom- ing.	Cali- fornia.	Com- mercial Texas.	Ohio.	gasoline.
Sp. gr.	0·8095	0·7939	0·8622	0·9200	0·9079	0·8816	0·9600	0·9466	—	—
Specific heat.	0·5000	0·4690	0·4532	0·4315	0·4355	0·4323	0·3980	0·4009	0·4951	0·5135

The heats of vaporisation of certain hydrocarbons were determined by means of the apparatus devised by Kahlenberg (*J. Physical Chem.*, 1901, 5, 215). The following results show a rapid decrease in the latent heat with increase in the molecular weight :

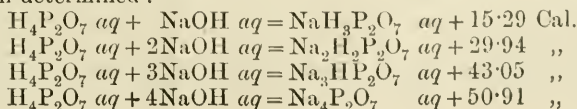
Hydrocarbon.	Hexane.	Heptane.	Octane.	Hexa- methyl- ene.	Dimethyl- penta- methyl- ene.	Methyl- hexa- methyl- ene.	Dimethyl- hexa- methyl- ene.
Boiling point ...	68°	98°	125°	68—70°	90—92°	98°	118—119°
Heat of vaporisa- tion (calories)..	79·4	74·0	71·1	87·3	81·0	75·7	71·7

E. G.

**Hydration of Zinc Oxide.** By ROBERT DE FORCRAND (*Compt. rend.*, 1902, 135, 36—39).—Zinc oxide prepared at 125° combines with water forming the crystallised hydroxide,  $Zn(OH)_2$ , with development of +2·19 Cal. (liquid water). The oxide prepared at a bright red heat, which is probably more or less polymerised, absorbs water in a moist atmosphere, forming hydroxides of different condensation, the heat developed per mol. of water being from 4·5 Cal. to 5·0 Cal. Similar results are obtained with the hydroxide prepared by precipitation. The condensation of  $nZn(OH)_2$  into  $[Zn(OH)_2]_n$  develops about  $n \times 3·8$  Cal.

C. H. B.

**The Acidity of Pyrophosphoric Acid.** By H. GIRAN (*Compt. rend.*, 1902, 134, 1499—1502).—The following heats of neutralisation have been determined :

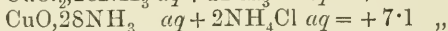


Neutralisation by the first mol. of sodium hydroxide evolves 15.29 Cal.; by the second mol. 15.65 Cal.; by the third mol. 13.11 Cal.; and by the fourth mol. 7.86 Cal. Pyrophosphoric acid is therefore a tetrabasic acid.

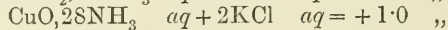
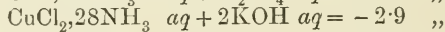
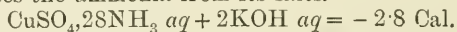
Solid pyrophosphoric acid was obtained by decomposing silver pyrophosphate with dry hydrogen chloride. Its heat of solution is +7.78 Cal. Since the heat of solution of syrupy pyrophosphoric acid is +10.22 Cal., it follows that this latter is in a superfused condition, its heat of fusion being -2.44 Cal.

Sodium trihydrogen pyrophosphate, prepared by the action of syrupy pyrophosphoric acid on disodium dihydrogen pyrophosphate at 100°, has heat of solution +0.67 Cal. The heats of solution of disodium dihydrogen pyrophosphate, trisodium hydrogen pyrophosphate, and tetrasodium pyrophosphate are respectively -2.18 Cal., +6.77 Cal., and +11.85 Cal. The difference in the heats of solution indicates that the salts are true compounds and not mixtures. J. McC.

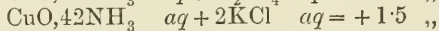
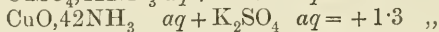
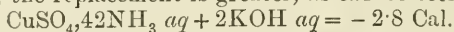
**Displacement of Strong Bases by Ammoniacal Cupric Oxide.** By ALBERT BOUZAT (*Compt. rend.*, 1902, 134, 1502—1505. Compare this vol., ii, 502).—The thermochemical action of solutions of ammoniacal cupric oxide on solutions of ammonium, potassium, and calcium salts has been measured:



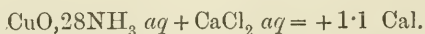
The difference between the actions is almost the same as that between the heats of neutralisation of the ammoniacal cupric hydroxide and ammonia (7.2 Cal.), consequently the complex base almost completely replaces the ammonia from its salts.



From these results, it is evident that the complex radicle partially replaces the potassium from its salts. In more concentrated ammoniacal solution, the replacement is greater, as can be seen from:



That the acid distributes itself between the two bases is proved by the fact that an ammoniacal cupric salt solution acquires the power of dissolving cellulose when potassium hydroxide is added, and cellulose is deposited from a solution of ammoniacal cupric hydroxide when a potassium salt is added. Cellulose is only soluble in a solution of the free base.



In this case also there is an equilibrium established between the amounts of base distributed between the acid, and in more concentrated ammoniacal solution the quantity of calcium replaced is so great that lime is precipitated.

The ammoniacal cupric hydroxide is to be regarded as a fairly strong base. J. McC.



**Heat of Dilution of Sodium Sulphate.** By ALBERT COLSON (*Compt. rend.*, 1902, 134, 1496—1497).—The point at which  $A = f(t) = 0^\circ$ , where  $t$  is the initial temperature of the solution, has been determined for solutions containing 200 grams of sodium sulphate in 100, 300, 500, 700, and 750 c.c. of water respectively. The points found were:  $59.5^\circ$ ,  $59.5^\circ$ ,  $57^\circ$ ,  $52^\circ$ , and  $52-53^\circ$ . J. McC.

**Theory of the Critical Phenomena and Vaporisation: Theory of Solution.** By ISODOR TRAUBE (*Ann. Physik.*, 1902, [iv], 8, 267—311).—The author gives an historical account of the study of the critical temperature and calls special attention to the apparent anomalies noticed by Ramsay, de Heen, Jamin, Mathias, Batelli, Guye, Dwelshauvers-Dery, and Galitzin. Ramsay observed phenomena which indicate that in a sealed tube above the critical temperature diffusion takes place, whilst de Heen and Dwelshauvers-Dery's experiments show that the density of a substance is not uniform about the critical temperature. These observations have been confirmed. A U-tube containing ether was heated for half-an-hour to  $10^\circ$  above the critical temperature, and on cooling it was observed that one limb filled with a cloud, whilst the other remained perfectly clear, and even above the critical temperature there was a visible meniscus at the low end of the tube quite like the meniscus of a liquid.

These observations lead the author to conclude that the view that the critical temperature is the point above which a substance can only exist in the gaseous condition is incorrect. The values of  $b$  in van der Waals' equation for non-associated liquids increase with rising temperature, the increase being greatest near the critical temperature. The value of  $b$  at the critical temperature is  $v_c/3$ ; it is shown that  $b$  increases even after the critical temperature has been reached, and it is to this change of  $b$  in passing from the liquid to the gaseous state that the anomalous observations referred to are attributed. At the critical temperature and at corresponding temperatures, the constant  $b$  and the co-volume  $v - b$  are proportional; consequently at the critical temperature the total volumes and the covolumes of a gasogenic and a liquidogenic molecule are in the same ratio as the gasogenic and liquidogenic constants  $b$ .

The author supposes that the increase in volume undergone by the atoms of a complex molecule during rise of temperature is not gradual but sudden. He assumes that there are two kinds of molecules—gasogenic and liquidogenic. These mutually dissolve each other and the amount of each present in any particular phase is conditioned by the temperature.

Van der Waals (*Abstr.*, 1901, ii, 644) has arrived at practically the same conclusion.

Liquids above absolute zero are solutions of gasogenic in liquidogenic molecules; these are in mobile equilibrium, but it requires a certain time for the establishment of this equilibrium. The critical temperature appears then as a triple point at which gasogenic and liquidogenic particles are completely miscible. When this is represented on a system of coordinates, using the value of  $b$  as ordinate and temperature as abscissa, the curve cuts the temperature axis at a

point above the critical temperature, which corresponds with the temperature above which only gasogenic particles can exist; for this point the term *absolute gasification point* is suggested.

According to this hypothesis, the whole of the pressure-volume curve for a substance at its critical temperature becomes realisable; the increase of volume with rising pressure is due to the passage from the liquidogenic to the gasogenic condition. It is shown that the volume of the gasogenic particle is almost twice that of the liquidogenic, and this is nearly the same for all substances.

It has been assumed that the heat of vaporisation at the critical temperature is zero; but Villard's experiments do not confirm this, and it is shown that according to the above hypothesis the heat of vaporisation at the critical temperature is  $0.41 T_c dp/dT \cdot v_c$ , where  $T_c$  is the critical temperature, and  $v_c$  the critical volume.

The relative quantities of liquidogenic and gasogenic particles at any particular temperature can be calculated as well as the heat of gasogenisation. At the normal boiling points, all solvents contain about the same proportion of gasogenic particles, namely, about 9 per cent. This leads to a discussion of the theory of solution; it is assumed that the dissolved substance influences the gasogenic particles, and thus by decreasing the proportion of them, hinders gasification and consequently raises the boiling point. The vapour pressure, the freezing point, and the osmotic pressure are influenced in the same way, and therefore van't Hoff's laws follow from the hypothesis. Electrolytes are assumed to influence twice the number of gasogenic particles that non-electrolytes do, and the author rejects the theory of Arrhenius and supports the older Clausius' assumption of continuous dissociation and association of the dissolved particles.

J. McC.

### Simultaneous Distillation of Two Non-miscible Substances.

By EUGÈNE CHARABOT and J. ROCHEROLLES (*Compt. rend.*, 1902, 135, 175—177).—When the value of  $P/P'$  is less than unity,  $P$  being the weight of non-miscible liquid which distils and  $P'$  the weight of water, this ratio increases as the temperature rises (by increasing the pressure). On the other hand, when the value of  $P/P'$  is greater than 1, it decreases as the temperature is increased. These conclusions have been experimentally confirmed in the former case with limonene, geraniol, citronellol, and methylheptenone, and in the latter with pinene, benzene, isopentane, *n*-hexane, and carbon tetrachloride.

J. McC.

**Diffusion of Hydrogen through Platinum.** By ADOLF WINKELMANN (*Ann. Physik.*, 1902, [iv], 8, 388—404. Compare Abstr., 1901, ii, 646).—Platinum has been examined in the same way that palladium was. The rate of diffusion of the hydrogen increases after the platinum has been heated for some time. It is proved that this is not due to expulsion of occluded air, but to the crystalline structure assumed by the metal. When the platinum has passed into this state it persists therein.

\* The diffusion of hydrogen through red-hot platinum is not proportional to the pressure of the gas, but it is probable that the diffusion

is accompanied by a dissociation of the molecules, and only the atoms of hydrogen pass through the metal. The results obtained agree well with the formula given previously.

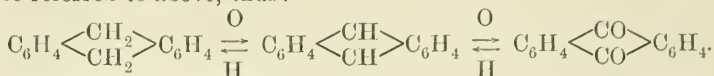
The experiments were made with a platinum tube 19 cm. long, 1 mm. in diameter, and 0.1 mm. thick in the walls. The metal was heated electrically. J. McC.

**Preparation of Cells for the Measurement of High Osmotic Pressures.** By HARMON N. MORSE and J. C. W. FRAZER (*Amer. Chem. J.*, 1902, 28, 1—23).—In a previous paper (Morse and Horn, *Abstr.*, 1901, ii, 543), a method was described for the electrolytic deposition of an osmotic membrane in the wall of a porous cell. The highest pressure which had then been reached with such a cell was 4.5 atmospheres, the inability to withstand higher pressures being due, not to the weakness of the membrane, but to the difficulty of securing the manometer in the cell. The present paper gives an account of improved arrangements for securing the manometer, and of certain modifications in the construction of the cell. By means of the improved apparatus, with a normal solution of sugar, a pressure of 31.5 atmospheres has been attained. The osmotic pressure of a seminormal solution of sugar at 20° was found to lie between 13 and 14 atmospheres. For details, the description and diagrams in the original must be consulted. E. G.

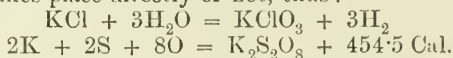
**Classification of the Elements.** By HENRY E. ARMSTRONG (*Proc. Roy. Soc.*, 1902, 70, 86—94).—On the assumption that the 'elementary difference' is about a unit, the elements are arranged in sixteen vertical series, the first horizontal period closing with oxygen. The molecule of argon is assumed to be diatomic, and that element appears immediately after fluorine; this position is in harmony with the author's view that argon is an element of intense activity, the molecule exhibiting no residual affinity, because the component atoms so completely satisfy each other. The atomic weight 77 is assigned to selenium, so that it may appear in the oxygen-sulphur group. It is not always possible, as it is in the first and second periods, to proceed by units; thus, in the third period, after scandium, it is necessary to step down five units to bring titanium into position. In the fourth period, iron and nickel both appear in the fourth column in order to bring copper into a suitable position. The chief point brought out by this mode of classification is the existence of groups of elements from the highest term of which alone 'progression' takes place. It is probable that when atomic weights are more accurately known, such grouped elements will be found only in columns 4, 8, and 12. J. C. P.

**Suggested Modifications of the Sign of Equality for use in Chemical Notation.** By HUGH MARSHALL (*Proc. Roy. Soc. Edin.*, 1902, 24, 85—87).—The symbol  $\rightleftharpoons$  is used for a double purpose: (1) to indicate that a reaction is reversible; (2) to indicate, especially in organic chemistry, the stages by which one substance may be obtained from another. To avoid this double use, the author makes the following suggestions:

(1) The use of the symbol  $\rightleftharpoons$  should be restricted to the second case referred to above, thus :

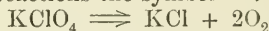


(2) The ordinary symbol  $=$  should be used only in equations required for purposes of calculation, irrespective of whether the change represented takes place directly or not, thus :

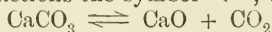


(3) In writing a complete equation, corresponding with some actual chemical change, singly-barbed arrows should be used, subject to the following modifications :

(a) for irreversible reactions the symbol  $\Rightarrow$ , thus :

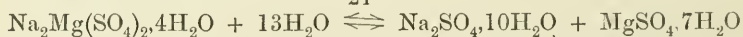


(b) for reversible reactions the symbol  $\rightleftharpoons$ , thus :

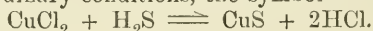


(c) for reversible reactions associated with a definite transition

temperature, the symbol  $\overset{t^\circ}{\rightleftharpoons}$  or  $\overset{t^\circ}{\rightleftharpoons}$ , thus :



(d) for cases where reversible reactions go almost completely in one direction under ordinary conditions, the symbol  $\Rightarrow$ , thus :



J. C. P.

**Principal and Supplementary Valencies and the Constitution of Ammonium Compounds.** By ALFRED WERNER (*Annalen*, 1902, 322, 261—296).—A theoretical communication enunciating the author's theories of valency, and containing a summary of the various views held at different periods on this subject.

An attempt is made to distinguish between two forms of valency. Principal valency ("Hauptvalenz") is the capacity for combination possessed by elementary or compound radicles which are either capable of existing in the ionised condition or which are equivalent to these ions. Supplementary valency ("Nebervalenz") is the affinity by virtue of which radicles which do not exist in the ionised condition can combine with one another.

For example, the following radicles,  $-\text{Cl}$ ,  $-\text{Na}$ ,  $-\text{NO}_2$ , and  $-\text{CH}_3$  possess principal valency, whilst the complexes,  $-\text{OH}_2$ ,  $-\text{NH}_3$ ,  $-\text{ClK}$ , and  $-\text{CrCl}_3$  enter into combination by virtue of their supplementary valency.

It is not always possible to differentiate between these two forms of valency, and in all probability they differ in degree rather than in kind.

The number of radicles which can combine with any given central element depends on the available space within this atom's sphere of influence rather than on the nature of the combining radicles. In the case of carbon, the maximum number of dependent radicles is undoubtedly four. Many other elements appear capable of combining with six radicles. The series  $[\text{Pt}(\text{NH}_3)_6]\text{X}_4$ ,  $(\text{PtCl}_6)\text{R}_2$ ,  $[\text{Pt}(\text{SCN})_6]\text{R}_2$  and



(PtBr<sub>6</sub>)R<sub>2</sub>, indicate that this is the maximum number ("coordination constant") in the case of platinum. The complex thus formed, however, still possesses residual affinity, and this is satisfied by combination with the radicle R in a second sphere of influence.

In general, the capacity for combination of an atom is determined by three factors, principal valency, supplementary valency, and the coordination constant.

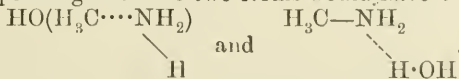
These hypotheses are employed in discussing the constitution of ammonium compounds.

It is pointed out that the theory which supposes that the hydrogen and chlorine of ammonium chloride are independently attached to the nitrogen does not account for the great difference in stability between the partially and completely substituted quaternary ammonium hydroxides. As an alternative hypothesis, the author suggests that the combination of ammonia and hydrogen chloride is due to the supplementary valency or residual affinity of the nitrogen and the acidic hydrogen, and ascribes to ammonium chloride the coordination formula  $H_3N \cdots H \cdot Cl$ , the supplementary valency being indicated by the dotted line. The corresponding formula for ammonium hydroxide is  $H_3N \cdots H \cdot OH$ . These formulæ account for the electrochemical behaviour of the compounds in aqueous solution, the salt, which still contains the chlorine ion attached to hydrogen, being strongly ionised, whilst the base resembles its prototype, water, in exhibiting an abnormally small ionisation.

The combination of methyl iodide and ammonia is supposed to result in the formation of the complex  $I(H_3C \cdots NH_3)$ , but, since the same compound is produced from hydrogen iodide and methylamine, it is probable that, in the former process, rearrangement occurs in the following manner:



Possibly the iodide contains the two forms in a state of dynamic equilibrium; the first modification is termed the "carbonium form," whilst the latter is referred to as the "hydronium form." The hydroxides corresponding with the two forms would have the formulæ



The instability of the partially substituted ammonium hydroxides is explained by assuming that owing to the presence of labile hydrogen the transformation into the hydronium form always occurs, and hence these bases have the characters of ammonium hydroxide itself. In the case of the tetra-alkyl ammonium hydroxides, this change is excluded, and, accordingly, these compounds are carbonium bases, differing from ammonium hydroxide in stability and in electrochemical behaviour.

According to this theory, two isomeric forms of the compound  $(NBA_3)X$ , are possible, and isomerism of this order has been observed by Le Bel, Schryver, and Aschan, Le Bel's isomeric salts being thus represented:  $X \cdot H_2CPr \cdots NMe_3$ , and  $X \cdot H_3C \cdots NMe_2C_4H_9$ .

These hypotheses are also applied to the constitution of the unsatur-

ated cyclic bases and to the diazonium salts; the discussion is, however, of such a nature that it cannot be profitably abstracted. G. T. M.

**New Extraction Apparatus.** By O. STEPHANI and TH. BÖCKER (*Ber.*, 1902, 35, 2698—2700).—The apparatus described is suitable for the extraction of liquids with a denser solvent, or for the extraction of solids with any solvent. It was found to work very well in such cases as the extraction of strong alkaline or acid solutions with chloroform, otherwise difficult owing to the formation of emulsions or the precipitation of inorganic salts. R. H. P.

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## Inorganic Chemistry.

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**Chlorinating Action of a Mixture of Hydrochloric Acid and Oxygen.** By CAMILLE MATIGNON (*Compt. rend.*, 1902, 134, 1497—1499).—Spongy platinum placed in a concentrated solution of hydrochloric acid in contact with the air is acted on, chloroplatinic acid being formed. There is no action on platinum foil at the ordinary temperature, but when this is heated at 170° for 5 hours with hydrochloric acid in a sealed tube containing oxygen, the platinum is dissolved. Gold foil is attacked under the same conditions at 180°; amorphous gold is not acted on in the cold. Tellurium is readily dissolved by the combined action of hydrochloric acid and oxygen. J. McC.

**Stability of Hypochlorites and Hypobromites.** By CARL GRAEBE (*Ber.*, 1902, 35, 2753—2756).—Hypochlorite solutions are much more readily prepared than hypobromite, as unless the bromine is added very slowly, considerable amounts of bromate are formed. One of the simplest methods of generating chlorine is from permanganate and hydrochloric acid; the increase in weight of the alkaline solution gives the amount of chlorine absorbed; in all cases, however, this amount is practically the theoretical quantity which could be obtained from the permanganate employed. A 10 per cent. solution of the alkali hydroxide is employed, and the resulting hypochlorite solution contains 5.5 grams of available chlorine per 100 c.c., and may be kept for some time in the dark without undergoing deterioration if excess of alkalis is present.

Hypobromite solutions are much less stable even when excess of alkali is present. J. J. S.

**Preparation of Periodic Acid by Electrolysis.** By ERICH MÜLLER and O. FRIEDBERGER (*Ber.*, 1902, 35, 2652—2659. Compare *Abstr.*, 1901, ii, 380).—On more closely investigating the formation of periodate in the electrolysis of an alkaline solution of iodate, it was found that the difference of potential between the electrodes became

greater during the electrolysis, and that, at the same time, the current efficiency in yield of periodate very largely increased. The accumulation of oxygen on the anode during electrolysis was the cause of this change. When lead peroxide was used as anode, iodic acid, which is not oxidised when platinum electrodes are employed, could be completely oxidised to periodic acid. In a small, porous cell containing 50 per cent. iodic acid, the anode, consisting of a U-shaped lead tube coated with peroxide, was placed; the cathode was platinum foil immersed in 2*N* sulphuric acid; the anode was cooled by running water through the lead tube. At a temperature of 12—13°, and using a current density of 0.28 ampere per sq. cm. at the anode, the whole of the iodic acid was converted into periodic acid, a slight loss occurring through diffusion. Replacement of the lead peroxide by manganese peroxide caused only a trace of iodic acid to be oxidised. When a solution of iodic acid is allowed to remain in contact with lead peroxide for a long time, a small quantity of periodic acid is formed. To isolate the acid from the anode liquid, the solution after dilution and filtration was evaporated, when periodic acid was obtained pure in large crystals.

In order to estimate periodic acid in the presence of iodic acid, the solution is exactly neutralised, using phenolphthalein as indicator; excess of potassium hydrogen carbonate is then added and potassium iodide; the periodate is reduced to iodate, and the equivalent amount of iodine which is set free is titrated with standard arsenious acid; this gives a quarter of the oxygen present as periodate; the total oxygen present, both as periodate and as iodate, is estimated by titrating the iodine set free from the acidified mixture.

K. J. P. O.

**Hydrides of the Second [Sulphur] Family of Metalloids.** By ROBERT DE FORCRAND and HENRI FONZES-DIACON (*Ann. Chim. Phys.*, 1902, [vii], 26, 247—271. Compare Abstr., 1900, ii, 405).—A detailed account of the study of the carefully purified hydrides of sulphur, selenium, and tellurium obtained by the decomposition of the corresponding aluminium compounds by water or dilute acid. Hydrogen selenide has the most toxic effect, the physiological action of the telluride being comparatively slight. A comparison of the physical properties of these gases with those of water affords a striking illustration of the rule that, in a given family of elements, and particularly in the oxygen and fluorine groups, the first and fourth terms differ markedly from their neighbours, whilst the two median elements resemble each other very closely.

G. T. M.

**Fluorides and Oxyfluorides of Sulphur.** By HENRI MOISSAN and PIERRE LEBEAU (*Ann. Chim. Phys.*, 1902, [vii], 26, 145—178).—A detailed account of work already published (compare Abstr., 1900, ii, 341, 342, 472; 1901, ii, 233). The results obtained indicate that fluorine, although the initial member of the halogen family, does not closely resemble chlorine and bromine. Sulphuryl fluoride and thionyl fluoride are far more inert than the corresponding chlorine derivatives, and sulphur hexafluoride is an unexpectedly stable substance. In certain respects, fluorine seems to behave like oxygen.

G. T. M.

**Persulphuric Acids.** By HENRY E. ARMSTRONG and T. MARTIN LOWRY (*Proc. Roy. Soc.*, 1902, 70, 94—99).—When Caro's acid is neutralised and the resulting solution heated, it becomes acid; it may further be shown that the ratio of increase in acidity to active oxygen lost ( $\text{SO}_3 : \text{O}$ ) is 1 : 2. This result is not in harmony with the formula,  $\text{H}_2\text{S}_2\text{O}_5$ , assumed by Baeyer and Villiger (*Abstr.*, 1901, ii, 380), for the salts of this acid would remain neutral after the removal of peroxide oxygen, thus:  $2\text{CaSO}_5 = 2\text{CaSO}_4 + \text{O}_2$ . On the other hand, the facts would be explained by the assumption of the formula  $\text{H}_2\text{S}_2\text{O}_9$ , for  $\text{CaS}_2\text{O}_9 + \text{H}_2\text{O} = \text{CaSO}_4 + \text{H}_2\text{SO}_4 + \text{O}_2$ . The acid  $\text{H}_2\text{S}_2\text{O}_9$  may be regarded as the anhydro-acid derived from permonosulphuric acid, that is, as  $\text{O}(\text{SO}_2 \cdot \text{O} \cdot \text{OH})_2$ . Reviewing the results obtained by Baeyer and Villiger (*loc. cit.*) and those by Lowry and West (*Trans.*, 1900, 77, 950), the authors think it necessary to assume that there are at least three persulphuric acids:

1. Pertetrasulphuric acid,  $\text{O}_2(\text{SO}_2 \cdot \text{O} \cdot \text{SO}_2 \cdot \text{OH})_2$ .
2. Perdisulphuric acid,  $\text{O}_2(\text{SO}_2 \cdot \text{OH})_2$ .
3. Peranhydrosulphuric acid (Caro's acid).

J. C. P.

**Compounds of Tellurium with Bismuth and the Quantitative Separation of the Two Elements.** By ALEXANDER GUTBIER (*Zeit. anorg. Chem.*, 1902, 31, 331—339. Compare *Abstr.*, 1901, ii, 687).—Tellurium and bismuth alloy in all proportions. The alloys were prepared by fusing a mixture of the finely-divided metals in a current of hydrogen. When tellurium is in excess, the alloy is grey, brittle, and when broken shows a silvery lustre; when bismuth is in excess, the alloy has a high metallic lustre and is not so brittle.

These elements can best be separated by shaking the precipitated sulphides with a solution of potassium sulphide. The tellurium in the solution can be precipitated by hydrazine hydrochloride or by sulphurous acid. When sulphurous acid is employed, the sulphuric acid formed can be removed by means of a solution of barium hydrogen carbonate.

J. McC.

**Some Salts of Telluric Acid.** By ALEXANDER GUTBIER (*Zeit. anorg. Chem.*, 1902, 31, 340—351).—The potassium tellurate,  $\text{K}_2\text{TeO}_4 \cdot 5\text{H}_2\text{O}$ , is obtained from a solution of telluric acid and one of potassium hydroxide. It separates in long, colourless needles which are very easily soluble in water. When heated to  $300^\circ$ , it loses oxygen and gives potassium tellurite. The salt,  $\text{K}_2\text{TeO}_4 \cdot 2\text{H}_2\text{O}$ , is obtained when telluric acid is dissolved in a concentrated boiling solution of potassium hydroxide, and the corresponding sodium salt is obtained in the same way. This sodium salt can also be obtained by adding absolute alcohol to a well-cooled solution of telluric acid and sodium hydroxide. It also gives off oxygen when heated. The sodium salt is much less soluble than the potassium salt.

The following tellurates can be obtained from a solution of the potassium salt; ceric tellurate as a pasty mass; thorium tellurate as a white, curdy precipitate; uranyl tellurate as a yellow, curdy precipitate; and zinc tellurate as a white precipitate.

With a neutral solution of silver nitrate, a solution of potassium



tellurate gives silver tellurate as a dark yellow precipitate which decomposes very easily into a basic tellurate.

It has not been possible to prepare any esters of telluric acid.

J. McC.

**Electrolytic Reduction of Nitric Acid in Presence of Hydrochloric Acid or Sulphuric Acid.** By JULIUS TAFEL (*Zeit. anorg. Chem.*, 1902, 31, 289—325).—When nitric acid is electrolysed, it suffers reduction, and in order to diminish the action of the nitric acid as an electrolyte a relatively large amount of sulphuric acid or hydrochloric acid was added to the solution. The product of the reduction is largely dependent on the nature of the metal used as electrode. With platinum, no appreciable reduction takes place, and with palladium the reduction is extremely slow. The chief products of the reduction are hydroxylamine and ammonia. The largest proportion of hydroxylamine is formed when mercury is used as the electrode, and the conversion of the nitric acid into this can be carried out almost quantitatively. With lead electrodes, about 40 per cent. of the nitric acid is converted into hydroxylamine, and with copper electrodes only about 15 per cent.; if the copper be in the form of a spongy mass, only about 1 per cent. of the acid is transformed into hydroxylamine, the remainder being reduced to ammonia. When an amalgamated electrode is used, the reduction takes place in the same way as when a mercury electrode is employed.

Hydroxylamine is not altered when subjected to electrolysis between copper electrodes. It is thus proved that the reduction of the nitric acid takes place in two ways independent of each other, the one giving hydroxylamine, the other ammonia; the course of the reaction depends on the specific nature of the electrode.

The current yield and the proportion of hydroxylamine formed when the nitric acid is electrolysed between electrodes of lead, cadmium, copper, silver, aluminium, tin, bismuth, nickel, and carbon are given in tables. The amount of hydroxylamine produced is greater as the solution of nitric acid is more dilute; in order to obtain the largest proportion, a very dilute solution of nitric acid should be employed, and more added as the reduction proceeds. When the amount of sulphuric acid present falls below 40 per cent., the quantity of hydroxylamine formed decreases appreciably, but otherwise the concentration of the sulphuric acid exerts no influence on the reaction.

In some experiments, the amounts of ammonia and of nitrogenous gas evolved, as well as the hydroxylamine, were determined. The amount of gas was always small.

The action of copper, mercury, and lead on nitric acid in presence of sulphuric acid has also been studied. With copper or mercury, no hydroxylamine is produced, and with lead reduction to nitrous acid takes place.

In the production of hydroxylamine, the current yield is greatest for lead, slightly smaller for amalgamated lead, and decidedly less for copper. The presence of nitrous acid exerts no appreciable influence on the reduction of nitric acid by these metals.

Incidentally, it has been proved that hydroxylamine sulphate is very

stable in presence of sulphuric acid, and the solution may be warmed to about  $40^{\circ}$  without any decomposition occurring.

The author believes that the electrolytic reduction of nitric acid may prove the best method of preparing hydroxylamine provided that suitable electrodes are used, that the temperature is kept low, that the nitric acid is employed in sufficiently dilute solution, and that fairly concentrated sulphuric acid is added to the solution.

Hydroxylamine hydrochloride can also be conveniently obtained when hydrochloric acid is employed in place of sulphuric acid, but the process is unpleasant on account of the simultaneous evolution of chlorine. J. McC.

**The Mixtures formed by Sulphur and Phosphorus below  $100^{\circ}$ .** By R. BOULOUCH (*Compt. rend.*, 1902, 135, 165—168).—The curve of solidification for varying proportions of sulphur and phosphorus has been determined. This consists of two lines which cut sharply at a point representing  $9.8^{\circ}$  and 22.8 per cent. of sulphur in the mixture. This is an eutectic point. The author concludes that below  $100^{\circ}$  no definite compound of sulphur and phosphorus is formed. Mixed crystals of sulphur and phosphorus, rich in sulphur, can be formed, and these are isomorphous with octahedral sulphur. Mixed crystals rich in phosphorus can also be isolated at low temperatures and these are isomorphous with phosphorus. J. McC.

**New Properties of Amorphous Silicon.** By HENRI MOISSAN and SAMUEL SMILES (*Compt. rend.*, 1902, 134, 1552—1553).—The amorphous silicon, obtained by sparking liquid silicon hydride (see following abstract), forms long filaments and possesses remarkable reducing properties. Thus neutral potassium permanganate is reduced slowly in the cold, copper sulphate and gold chloride on boiling; mercuric chloride is reduced to calomel. In these properties, silicon resembles pure boron (*Abstr.*, 1892, 1153). K. J. P. O.

**New Researches on Liquid Silicon Hydride.** By HENRI MOISSAN and SAMUEL SMILES (*Compt. rend.*, 1902, 134, 1549—1552. Compare this vol., ii, 318).—The vapour density of liquid silicon hydride, taken by Gay-Lussac's method at  $100^{\circ}$ , was 2.37, corresponding with that required for the formula  $\text{Si}_2\text{H}_6$ .

On sparking the vapour under reduced pressure for 15 minutes, it is completely decomposed into amorphous silicon and hydrogen. The hydride is soluble in ethyl silicate and slightly so in water; in the latter solution, it is gradually oxidised. It reduces aqueous ferric chloride, forming a brown precipitate insoluble in hydrochloric acid; a dilute solution of indigo is decomposed with the production of a green precipitate; both acidified potassium dichromate and neutral permanganate are immediately reduced. When the gas is bubbled through warm bromine water, each bubble becomes coated with a layer of silica; nitric acid produces a similar effect; concentrated hydrochloric acid is without action; sulphuric acid dries the gas and causes it to explode more violently when brought in contact with air. On mixing the substance with carbon tetrachloride, a violent explosion with the

production of a flame occurs, hydrogen chloride, carbon, and silicon being formed; it also explodes violently with sulphur hexafluoride.

K. J. P. O.

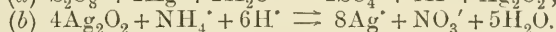
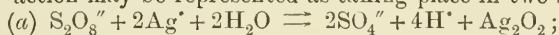
**Cæsium Compounds.** By CAMILLE CHABRIÉ (*Ann. Chim. Phys.*, 1902, [vii], 26, 212—228. Compare Abstr., 1901, ii, 314, 600).—*Cæsium vanadate*,  $\text{CsVO}_3$ , is a crystalline salt obtained by boiling vanadic anhydride with a solution of cæsium carbonate. The other compounds of cæsium referred to in this communication have already been described.

G. T. M.

**Crystallography of Ammonium Haloid Compounds.** By FR. SLAVÍK (*Zeit. Kryst. Min.*, 1902, 36, 268—276).—Crystallographic determinations are given for ammonium chloride, ammonium bromide, and ammonium iodide, and for tetramethylammonium iodide, tetraethylammonium iodide, and tetrapropylammonium iodide. Although these belong to different crystal-systems, yet a certain relation is traced between the topic axes.

L. J. S.

**Action of Silver Salts on Solutions of Ammonium Persulphate.** By HUGH MARSHALL and J. K. H. INGLIS (*Proc. Roy. Soc. Edin.*, 1902, 24, 88—93).—It has previously been shown (*Proc. Roy. Soc. Edin.*, 23, 163) that, in presence of a soluble silver salt, ammonium persulphate is decomposed with formation of nitric and sulphuric acids. On the assumption that silver peroxide is formed intermediately, the action may be represented as taking place in two stages:



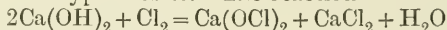
The total silver concentration being small compared with the persulphate concentration, the concentration of  $\text{Ag}^+$  and  $\text{Ag}_2\text{O}_2$  may be regarded as constant; equation (a) is then unimolecular, and in fact the course of the reaction, as indicated by the increase of acidity, corresponds with that required by the equation  $dc/dt = KC$ , where  $C$  is the concentration of the persulphate ions. When sodium nitrate, ammonium sulphate, or ammonium nitrate is added to the reaction mixture,  $K$  is still constant, but has a rather smaller value than when no neutral salt has been added, the neutral salt diminishing the concentration of the persulphate ions. When nitric or sulphuric acid is added to the reaction mixture, the reaction appears at first to be accelerated, but the end point is not the same as in the previous cases, probably owing to some other action that produces less acid, such as  $2\text{Ag}_2\text{O}_2 + 4\text{H}^+ = 4\text{Ag}^+ + \text{O}_2 + 2\text{H}_2\text{O}$ . Instead of assuming that  $\text{Ag}_2\text{O}_2$  is formed, it may be assumed that silver peroxide is a very feebly basic oxide the salts of which are readily hydrolysed.

J. C. P.

**Silver-chabazite and Silver-analcite.** By GEORGE STEIGER (*Amer. J. Sci.*, 1902, [iv], 14, 31—32).—Analcite, or the artificial product ammonium-analcite (this vol., ii, 269), when fused for some time with silver nitrate yields a product with the composition  $\text{Ag}_2\text{O}, \text{Al}_2\text{O}_3, 4\text{SiO}_2, 2\text{H}_2\text{O}$ , this being the analcite formula with silver in place of sodium. The ammonium derivative of chabazite is acted on by silver nitrate in the same way.

L. J. S.

**Composition of Bleaching Powder.** By WOLDEMAR VON TIESENHOLT (*J. pr. Chem.*, 1902, [ii], 65, 512—527. Compare Abstr., 1901, ii, 154).—Contrary to Foerster's assumption (Abstr., 1899, ii, 278), the evolution of chlorine brought about by mixing aqueous solutions of sodium chloride and hypochlorous acid is not due to formation of chloric acid, but must take place according to the equation  $\text{NaCl} + \text{HClO} = \text{NaOH} + \text{Cl}_2$ . The presence of calcium hypochlorite in bleaching powder is shown by extracting with alcoholic chloroform; the residue contains the percentage of chlorine as calcium chloride unchanged, the chloroform solution on titration with sodium thio-sulphate gives results approximately equivalent to the calculated amount of calcium hypochlorite. The reaction



is reversible. The evolution of chlorine, when bleaching powder is heated, is demonstrated by boiling with carbon tetrachloride, which dissolves chlorine but not hypochlorous acid. Chlorine is also evolved when bleaching powder is ground with calcium chloride.

G. Y.

**The Atomic Weight of Radium.** By SKŁODOWSKA CURIE (*Compt. rend.*, 1902, 135, 161—163).—The atomic weight of radium was determined by estimating the quantity of chlorine in radium chloride which was obtained by fractional crystallisation of radiferous barium chloride. The mean value of the results found is 225 and the author thinks that this is correct to 1 unit. Anhydrous radium chloride is spontaneously luminous. In chemical properties, radium is an element of the alkaline earth series.

J. McC.

**Precipitation of Cupric Chloride and Bromide by Sulphuric Acid.** By GEORGES VIARD (*Compt. rend.*, 1902, 135, 168—170).—By the addition of excess of concentrated sulphuric acid to a solution of cupric chloride, the yellowish, anhydrous salt is deposited if there is more than 68 per cent. of sulphuric acid present. If the acid be added slowly so that the temperature does not rise too high, the chloride is scarcely decomposed and the precipitation is almost complete. If the quantity of sulphuric acid added is too small, the green dihydrate,  $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ , is deposited.

The action with cupric bromide is quite analogous; the black, anhydrous salt can be completely precipitated. The bromide is, however, attacked by the sulphuric acid to a slightly greater extent than the chloride; although, even at a high temperature, the decomposition is very small. These reactions may be used to differentiate between a chloride and a bromide.

J. McC.

**Yellow Cuprous Oxide.** By MAX GRÖGER (*Zeit. anorg. Chem.*, 1902, 31, 326—330).—It has not been possible to obtain cuprous oxide quite pure by precipitating a solution of cuprous chloride with sodium hydroxide. If, however, a clear solution of cuprous chloride is slowly dropped into a concentrated solution of sodium chloride in excess of sodium hydroxide (also containing some potassium hydrogen tartrate) which is violently stirred, the cuprous oxide is obtained as a



yellow precipitate which is washed with a solution of sodium chloride, then with pure water. When dried, it forms a brownish-yellow powder. It contains no combined water, and is therefore not a hydroxide. It appears to be a hydrated, amorphous, cuprous oxide.

J. McC.

**Cerium Silicide.** By JEAN STERBA (*Compt. rend.*, 1902, 135, 170—172).—By heating together cerium oxide and silicon in the electric furnace, cerium silicide,  $\text{CeSi}_2$ , is formed. It forms small crystals with a steely lustre which give a black powder; the density at  $17^\circ$  is 5.67. It is only slowly acted on by water; hydrogen is without action on it. Fluorine acts in the cold on it, chlorine, bromine, or iodine only after heating. When heated to redness, it burns in oxygen with a vivid incandescence and when heated in boiling sulphur or selenium, it burns. Hydrogen chloride acts on it at a red heat. Solutions of hydrochloric and hydrofluoric acids attack it with evolution of hydrogen. Hydrogen sulphide and water are attacked at a red heat. Alkalis and ammonia do not react with it in the cold.

J. McC.

**Redetermination of the Atomic Weight of Lanthanum.** By HARRY C. JONES (*Amer. Chem. J.*, 28, 1902, 23—34).—The double nitrate of ammonium and lanthanum was fractionally crystallised until spectroscopic examination showed that it contained no impurity except a trace of cerium. It was then ignited, and the resulting oxide was dissolved in dilute nitric acid. The nitrate solution was treated with specially purified oxalic acid; the oxalate was ignited, the oxide was redissolved in nitric acid, and the oxalate reprecipitated and again ignited. When the product was heated to redness in a current of hydrogen, its weight remained constant, showing that no higher oxide than the sesquioxide was present. A weighed quantity of this oxide was then converted into the sulphate. Brauner and Pavlíček (*Trans.*, 1901, 81, 1243) have expressed the opinion that the sulphate method is untrustworthy, owing to the presence of the acid sulphate in the product; the author, however, was able to obtain the salt free from the acid sulphate and found that the presence or absence of the latter depends on the temperature to which the sulphate has been heated. The mean of 12 determinations gave the atomic weight 138.77 ( $\text{O} = 16$ ,  $\text{S} = 32.06$ ).

An attempt was made to determine the atomic weight by means of the oxalate, but the method was abandoned on account of the impossibility of obtaining the oxalate of constant weight.

E. G.

**Action of Hydrochloric Acid on the Sulphates of Aluminium, Chromium, and Iron.** By ALBERT RECOURA (*Compt. rend.*, 1902, 135, 163—165).—By the action of hydrochloric acid on aluminium sulphate and chromium sulphate, the chlorosulphates,  $\text{AlSO}_4\text{Cl} \cdot 6\text{H}_2\text{O}$  and  $\text{CrSO}_4\text{Cl} \cdot 6\text{H}_2\text{O}$ , have been obtained.

The chromium chlorosulphate was prepared by dissolving chromium sulphate in hot concentrated hydrochloric acid. On cooling, it separates as a green powder which is very soluble in water. Cryoscopic experiments show that the salt has the simple formula given. The chlorine which it contains is not precipitable by silver nitrate, but the sulphuric acid is completely precipitated by barium chloride.

When kept at  $85^{\circ}$ , it gradually loses water; when 1 mol. has been lost and the residue,  $\text{CrSO}_4\text{Cl}\cdot 5\text{H}_2\text{O}$ , is dissolved in water, the solution gives no precipitate with barium chloride. The molecular lowering of the freezing point of water brought about by this salt is  $18\cdot8$ , proving that it does not undergo dissociation.

No corresponding ferric chlorosulphate has been obtained.

J. McC.

**Action of Fused Sodium Dioxide on Metals.** By WILLIAM L. DUDLEY (*Amer. Chem. J.*, 1902, 28, 59—66. Compare Abstr., 1897, ii, 171).—When nickelo-nickelic hydroxide is heated at  $240^{\circ}$ , nickelo-nickelic oxide,  $\text{Ni}_3\text{O}_4$ , is obtained as a hygroscopic, black, amorphous powder which absorbs 7·4 per cent. of water from the air at  $30^{\circ}$ , but loses it completely at  $110^{\circ}$ ; it is non-magnetic, and differs markedly from the oxide prepared by Baubigny (Abstr., 1879, 299) by passing oxygen over heated nickel chloride.

Iron, gold, silver, and platinum are rapidly attacked by fused sodium dioxide. In the case of iron, dark-red, tabular crystals are produced which have the composition  $\text{Fe}_2\text{O}_3\cdot\text{H}_2\text{O}$ , and sp. gr. 3·8 at  $27^{\circ}$ . This substance is magnetic, and when heated to low redness leaves a residue of the oxide,  $\text{Fe}_2\text{O}_3$ , which is also magnetic.

When sodium dioxide is fused on gold, oxidation seems to take place, but the oxide formed is immediately decomposed, leaving the metal in a spongy state.

In the case of silver, the fused mass becomes filled with needle-shaped crystals; if the product is washed in a Soxhlet extraction apparatus, a black, amorphous residue is obtained and the washings gradually become wine-coloured. Both the precipitate and washings are found to contain silica, the presence of which is due to corrosion of the glass apparatus. By washing the product of the fusion in a platinum Gooch crucible, grey crystals were obtained of the composition Ag, 97·99; O, 1·82 per cent.; after washing this substance with strong ammonia, the residue was found to contain only 0·175 per cent. of oxygen.

When spongy platinum is heated with fused sodium dioxide, and the product washed with water, a yellowish substance is obtained which seems to consist of an unstable sodium salt of the yellow hydroxide. After neutralising the alkali and again washing, the product has the composition  $\text{Pt}_2\text{O}_3\cdot 2\text{H}_2\text{O}$ ; it is reduced to platinum black by boiling with sodium hydroxide and alcohol. It is insoluble in nitric and sulphuric acids and in cold dilute hydrochloric acid, but is dissolved by hot concentrated hydrochloric acid in presence of air with formation of platinic chloride. It does not lose water at  $100^{\circ}$ , but loses 5·22 per cent. at  $385^{\circ}$ , and at about  $450^{\circ}$  is converted into platinum sesquioxide,  $\text{Pt}_2\text{O}_3$ , which forms a dark-brown, amorphous powder.

E. G.

**Chromium Hydroxide.** By W. FISCHER and W. HERZ (*Zeit. anorg. Chem.*, 1902, 31, 352—358).—Freshly precipitated chromium hydroxide is soluble in solutions of alkalis, but is easily converted (by drying or heating) into a modification which is insoluble. From

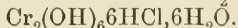
dialysis experiments with the solution in alkali, it is evident that the chromium hydroxide is dissolved in the colloidal form, and this is confirmed by the results obtained for the conductivity of the alkali solution before and after having the chromium hydroxide dissolved in it.

Ammonia dissolves chromium hydroxide forming a reddish-violet solution, from which the hydroxide, however, separates on standing. Methylamine behaves like ammonia, whilst dimethylamine and trimethylamine at once precipitate the chromium hydroxide completely. Tetramethylammonium hydroxide behaves like potassium or sodium hydroxide.

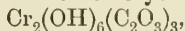
J. McC.

**Constitution of the Compounds of Chromium. I.** By GRÉGOIRE N. WYROUBOFF (*Bull. Soc. Chim.*, 1902, [iii] 27, 666—679).—If potassium oxalate is added to a solution of any violet salt of chromium, prepared in the cold, violet crystals of chromium oxalate,  $\text{Cr}_2\text{O}_3 \cdot 3\text{C}_2\text{O}_3 \cdot 25\text{H}_2\text{O}$  are obtained, which on being left exposed to the air, pass into a lower hydrate containing  $12\text{H}_2\text{O}$ . If the latter, placed in a well-corked tube, be heated to more than  $25^\circ$ , it liquefies to a liquid of the same composition. Dried over sulphuric acid, a violet "varnish" containing  $7\text{H}_2\text{O}$  is obtained, and on heating to  $110^\circ$  there is a loss of  $3\text{H}_2\text{O}$ , the colour at the same time becoming green.

To explain the various facts concerning the different compounds of chromium, the author considers the existing ideas with regard to salt formation to be too simple. With reference to the sesquioxides in particular, he considers that their compounds contain water of constitution when they form *normal* salts and become anhydrous only when they become 'complex compounds'; they act, not only in virtue of the metal, but also and especially in virtue of the hydroxyl groups which they contain. In the interaction with acids, the latter act as points of attachment for the acid. Applying these views, the formula of crystalline chromium chloride will not be  $\text{Cr}_2\text{Cl}_6 \cdot 12\text{H}_2\text{O}$ , but



If any of the hydroxyl groups take part in the interaction, not *salts*, but *esters*, will be obtained. The non-crystallisable oxalate,



the author regards, not as a salt, but as a true ester. He also arrives at the conclusion that the hydroxide of the green compounds is not  $\text{Cr}_2(\text{OH})_6$ , in which the hydroxyl groups have all the same function, but an hydroxide,  $\text{Cr}_2(\text{OH})_2(\text{OH})_4$ , in which the hydroxyl groups are partly acid and partly basic. So long as there are six hydroxyl groups to form  $\text{Cr}_2(\text{OH})_6$ , the compounds will be violet; if water is withdrawn, the hydroxyl groups become individualised and the compounds are green. For sulphochromic acid, the author proposes the formula  $\text{Cr}_2\text{O}_2(\text{OH})_2(\text{OH})_2(\text{SO}_2)_4\text{O}_2(\text{OH})_2$ .

A. F.

**Action of Hydrogen Peroxide and Sodium Hypochlorite on the Oxides of Thorium, Zirconium, and Cerium.** By L. PISSARJEWSKY (*Zeit. anorg. Chem.*, 1902, 31, 359—367).—By the action of hydrogen peroxide on a concentrated solution of thorium nitrate, a precipitate is formed which is probably thorium peroxide,  $\text{Th}(\text{O}_2\text{H})_4$ . This suffers hydrolysis, so that  $\text{Th}(\text{O}_2\text{H})_3 \cdot \text{OH}$  and  $\text{Th}(\text{O}_2\text{H})_2(\text{OH})_2$  are pro-

duced on washing the precipitate. With zirconium, a similar result is obtained. With ceric sulphate, a gelatinous substance is formed which resembles ceric peroxide, and at the same time a pulverulent precipitate is produced which may be a compound of the peroxide,  $\text{CeO}_3$ , with sulphuric acid.

The peroxides of the three metals can be obtained by treatment of the hydroxides with hydrogen peroxide. The following heats of neutralisation of 1 mol. of the hydroxide and 1 mol. of hydrogen peroxide have been calculated:  $\text{Th}(\text{OH})_4$ , 8.810 cal.;  $\text{Ce}(\text{OH})_4$ , 2.704 cal.; and  $\text{Zr}(\text{OH})_4$ , 1.314 cal.

The action of hypochlorite on solutions of thorium salts was studied by examining the products of the electrolysis of a mixed solution of an alkaline solution of sodium chloride and thoric oxide. At the same temperature and with the same current strength, the proportion of  $\text{ThO}_2$  which passes into the peroxide,  $\text{ThO}_3$ , is independent of the total amount of thorium present. The proportion of peroxides formed increases with the temperature and with the current strength.

By the electrolytic process, the existence of  $\text{CeO}_3$  could not be proved.  
J. McC.

**Metathorium Oxychloride.** By HENRY P. STEVENS (*Zeit. anorg. Chem.*, 1902, 31, 368—372).—The author maintains the conclusions previously given (Abstr., 1901, ii, 391) as to the composition and nature of metathorium oxychloride against the criticism of Wyruboff (Abstr., 1901, ii, 604).

The method of preparing the oxychloride by means of the oxalate is better than that adopted by Wyruboff. The opalescence of the solution is due to the oxychloride and not to any impurity, as Wyruboff suggests.  
J. McC.

**Double Nitrites of Iridium.** By ÉMILE LEIDIÉ (*Compt. rend.*, 1902, 134, 1582—1584. Compare Abstr., 1901, ii, 62).—When aqueous potassium nitrite is added to a concentrated solution of potassium irido- or iridi-chloride, a yellow or rose-coloured precipitate is obtained, which consists of a mixture of a double nitrite of potassium and iridium and potassium chloride, and is not a compound of the double nitrite and potassium iridochloride, as Lang thought; it yields only a trace of hydrogen chloride when heated with hydrogen, and dissolves in boiling water, but deposits, on cooling, a solid still containing some potassium chloride, from which it cannot be freed by this process.

A double *chloronitrite*,  $\text{Ir}_2\text{Cl}_2(\text{NO}_2)_4 \cdot 6\text{KCl}$ , is prepared by mixing solutions of potassium nitrite and iridochloride, filtering off the precipitate, saturating with potassium chloride, and evaporating at a low temperature; the salt forms lemon-yellow crystals and is decomposed by boiling water; it is identical with the salt described by Gibbs as the double nitrite.

The double *nitrite*,  $\text{K}_6\text{Ir}_2(\text{NO}_2)_{12}$ , is obtained by adding potassium nitrite to a warm solution of iridium sulphate; it is a white powder, insoluble in cold water, and is converted by hydrochloric acid into the iridichloride. The corresponding sodium salt is soluble and can be pre-



pared in a similar manner. The *ammonium* salt,  $(\text{NH}_4)_6\text{Ir}_2(\text{NO}_2)_{12}$ , is prepared from the sodium salt, and is nearly insoluble in cold water; when boiled with water, nitrogen is evolved. K. J. P. O.

## Mineralogical Chemistry.

**Italian Petroleum.** By LUIGI BALBIANO (*Gazzetta*, 1902, 32, i, 437—447).—[With MARIO PALLADINI.]—Examination of a sample of petroleum from Valleia, near Piacenza, shows that the fractions distilling at 57—87° contain no olefines, but probably methylcyclopentane, cyclohexane and benzene. T. H. P.

**Roumanite from the Black Sea.** By CONSTANTIN I. ISTRATI (*Bull. Soc. Sci. Bucarest*, 1901, 9, 650—652).—A small piece of yellow, translucent amber has been found in the sand on the coast of the Black Sea at Tékir-Ghiol. It differs somewhat in composition from other specimens of Roumanian amber (compare Abstr., 1897, ii, 502; 1898, ii, 523):

C.	H.	S.	Ash.	Sp. gr.
79.74	10.15	2.53	0.043	1.0985

L. J. S.

**Greenockite on Calcite from Joplin, Missouri.** By H. B. CORNWALL (*Amer. J. Sci.*, 1902, [iv], 14, 7—8).—The bright yellow, dusty coating on calcite from Joplin, Missouri, was found to contain about 30 per cent. of cadmium sulphide; it is therefore mainly greenockite ( $\text{CdS}$ ), like the yellow coating on zinc-blende from the same locality. L. J. S.

**Manganiferous Nodules in the Boulder-clay of Essex.** By MAY THRESH (*Essex Naturalist*, 1902, 12, 137—139. Compare Abstr., 1898, ii, 390).—In certain soils in Essex, where these overlies boulder-clay, there are present, to the extent of 0.1 per cent., small, hard, black nodules resembling seeds in appearance, the largest being 5 mm. in diameter. The following analyses of these nodules show that they consist of siliceous sand cemented by iron and manganese oxides, with some calcium phosphate and carbonate:

$\text{SiO}_2$ .	$\text{Fe}_2\text{O}_3$ .	$\text{MnO}_2$ .	$\text{MnO}$ .	$\text{CaO}$ .	$\text{H}_2\text{O}$ .	$\text{P}_2\text{O}_5$ , $\text{CO}_2$ , &c.	Total.
47.90	29.91	5.12	3.44	2.45	7.00	4.18	100.00
51.86	23.89	9.35	2.07	3.54	5.60	3.69	100.00

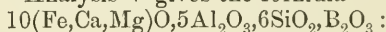
The manganese oxides have probably been deposited from an alkaline solution. L. J. S.

**Crystalline Limestones of Ceylon.** By ANANDA K. COOMARA-SWAMY (*Q. J. Geol. Soc.*, 1902, 58, 399—422. Compare Abstr., 1901, ii, 110).—A description is given of the crystalline limestones and

their mode of occurrence, especially in the Kandy and Hakgala districts. The limestones enclose several silicates (forsterite, phlogopite, diopside, amphibole, clinohumite, scapolite) and other accessory minerals (spinel, blue apatite, pyrite, graphite). The following mineral analyses (I and V by G. T. Prior; II—IV by W. C. Hancock) are given. I, Forsterite from Hakgala; II, forsterite from Ampitiya; III, colourless amphibole; IV, clinohumite from Gettembe;

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	Na <sub>2</sub> O.	H <sub>2</sub> O.	F.	Total.	Sp. gr.
I.	42.55	0.23	—	2.36	1.43	51.97	—	1.68	—	100.22	3.14
II.	41.16	—	2.58	—	—	52.60	—	3.8	—	100.14	3.13
III.	47.04	13.76	trace	—	13.39	21.26	4.01	0.60	—	100.36	2.92
IV.	37.52	trace	9.00	—	—	49.75	1.44	1.50	1.02	100.23	—

A new mineral, *serendibite*, was found in diopside-bands between limestone and acid granulite in the moonstone pits at Gangapitiya, twelve miles east of Kandy. The embedded crystals are of a dark bluish-green colour and are strongly pleochroic (very pale yellowish-green to deep indigo-blue). The optical characters and repeated twinning indicate that the mineral is probably triclinic. Sp. gr. 3.42; hardness about 7. Analysis V gives the formula



	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O,	Li <sub>2</sub> O.	P <sub>2</sub> O <sub>5</sub> .	Loss on igni- tion.	F.	B <sub>2</sub> O <sub>3</sub> .	Total.
V.	25.33	34.96	4.17	14.56	14.91	0.22	0.51	—	0.48	0.69	trace	[4.17]	100.00

L. J. S.

**Occurrence of Uranophane in Georgia.** By THOMAS L. WATSON (*Amer. J. Sci.*, 1902, [iv], 13, 464—466).—Uranophane has been found at Stone Mountain, 16 miles east of Atlanta, as a thin, sulphur-yellow to lemon-yellow incrustation on the surfaces of joint planes in granite. Deducting impurities (MgO 1.98, Al<sub>2</sub>O<sub>3</sub> 6.33 per cent., Fe<sub>2</sub>O<sub>3</sub>, P<sub>2</sub>O<sub>5</sub>), the recalculated analysis is given as :

CaO.	UO <sub>3</sub> .	SiO <sub>2</sub> .	H <sub>2</sub> O.	Total.
6.14	61.37	18.93	13.56	100.00

This corresponds with the formula  $\text{CaO}, 2\text{UO}_3, 3\text{SiO}_2, 7\text{H}_2\text{O}$ . The excess of silica over that given in Genth's formula, is probably due to the presence of hyalite, which is deposited on the uranophane.

The grey, biotite-bearing moscovite-granite has the following composition :

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	Na <sub>2</sub> O.	K <sub>2</sub> O.	H <sub>2</sub> O.	Total.
72.56	14.81	0.84	1.19	0.20	4.94	5.30	0.70	100.54

L. J. S.

**Beryl from Bosnia.** By FERDINAND KOCH (*Wiss. Mitth. aus Bosnien u. d. Hercegovina*, 1902, 8, 427—436).—A detailed description is given of crystals of beryl which occur in pegmatite in the Motajica planina mountains. The crystals exhibit optical anomalies. Analyses gave I for bluish-green and II for colourless crystals :

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	BeO.	Fe <sub>2</sub> O <sub>3</sub> (FeO).	CaO.	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Loss on ignition.	Total
I.	65.73	14.58	11.48	2.84	0.32	0.45	0.39	0.77	0.19	2.53	99.28
II.	65.68	14.69	11.55	2.68	0.31	0.43	0.32	0.68	0.18	2.36	99.88

L. J. S.

**Analyses of Italian Bauxite.** By CARLO FORMENTI (*Gazzetta*, 1902, 32, i, 453—461).—The author states that samples of genuine bauxite have now been found in the province of Aquila in Southern Italy. The results of the physical and chemical examinations are given. The percentage of alumina present in the specimens varies from 51.13 to 57.52.

T. H. P.

[**Natron-phlogopite.**] By ERNST WEINSCHENK (*Zeit. Kryst. Min.*, 1902, 36, 317; from *Abhandl. Akad. Wiss. München.*, 1900, 21, 272).—In an account of the graphite deposits of Styria, the following analysis (by L. Wunder) is given of a colourless mica from crystalline limestone. The mineral has, besides a perfect basal cleavage, also a prismatic cleavage, as in the “brittle micas”; the optic axial angle is small. Sp. gr. 2.84:

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	MgO.	CaO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Total.
44.74	30.63	2.59	5.92	1.58	2.32	6.09	5.85	99.72

L. J. S.

**Action of Copper Sulphate on Iron Meteorites.** By OLIVER C. FARRINGTON (*Amer. J. Sci.*, 1902, [iv], 14, 38—42).—Wöhler, in 1852, observed that certain meteoric irons are not capable of reducing copper sulphate; the same observation has been made by other authors, and the distinctions “active” and “passive” have thus come to be applied. The present author, however, finds that copper is deposited on freshly cleaned surfaces of many of the irons which have been described as passive. The time (1 to 4 minutes at 18°) which elapses before copper is deposited varies with the amount of nickel present in the iron and with the temperature, but is independent of the concentration of the solution.

L. J. S.

**Meteorite from Admire, Kansas.** By GEORGE P. MERRILL (*Proc. U.S. National Museum*, 1902, 24, 907—913).—Several masses of this meteorite, weighing in the aggregate about 30 kilograms, have been ploughed up at Admire in Lyon Co. Sp. gr. 3.95—4.2. Angular fragments of olivine are set in a base, forming about one-third of the whole mass, of nickel-iron; schreibersite, troilite, chromite, and lawrencite are also present. Veins of the metallic minerals penetrate cracks in the olivine. The following analyses are given: I, nickel-iron; II, olivine; III, chromite.

	Fe.	Ni.	Co.	S.	P.	Cu.
I.	93	6	0.02	0.03	0.025	trace
	SiO <sub>2</sub> .	Cr <sub>2</sub> O <sub>3</sub> .	FeO.	MgO.	Total.	
II.	39.14	—	13.185	47.63	99.955	
III.	0.50	65.49	33.00	0.40	99.39	

The metallic constituents, which have clearly been introduced subsequent to the shattering of the olivine, have probably been derived from the lawrencite and troilite.

L. J. S.

**Meteoric Stone from Zavid, Bosnia.** By FRIEDRICH BERWERTH (*Wiss. Mitth. aus Bosnien u. d. Hercegovina*, 1902, 8, 409—426).—On August 1st, 1897, there was a fall of meteoric stones near Zavid in the Zvornik district; four stones were found, the largest of which weighed rather more than 60 kilograms. The stone is chondritic and consists largely of olivine and bronzite; it contains also a monoclinic pyroxene (?), plagioclase, glass, troilite, chromite and nickel-iron. A bulk analysis of the stone by C. Hödlmoser gave:

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	Na <sub>2</sub> O.	K <sub>2</sub> O.	S.	Fe.	H <sub>2</sub> O.	Total.
41.90	1.92	27.40	4.60	22.79	1.05	0.41	1.01	0.15	0.39	101.62

L. J. S.

**Alkaline Waters from the Lower Greensand.** By WALTER W. FISHER (*Analyst*, 1902, 27, 212—217).—Waters from the greensand, where the latter is exposed, are generally good and soft in character. The total solids, chlorine, and organic matter are sometimes quite small, whilst notable quantities of nitrates and iron are occasionally present. In the counties of Oxford and Buckingham, the greensand, and the Portland beds which underlie it, both gradually dip beneath the gault clay, and the water is here reached by deep borings. This water is materially different from that obtained from the uncovered beds. It contains considerable quantities of alkali chlorides, sulphates, and carbonates; the amount of nitrates is small, but the ammonia is large. The composition and quantity of the mineral constituents, however, was found to vary, even in wells a few miles apart. This is due to the fact that in places the water escapes by natural outlets, causing continual percolation through the beds and removal of soluble constituents.

W. P. S.

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## Physiological Chemistry.

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**The Effect of Decompression on the Respiratory Exchange of Man.** By J. TISSOT (*Compt. rend.*, 1902, 134, 1255—1258).—The respiratory exchanges were studied in the human subject, placed in a suitable chamber from which the air could be exhausted. It was found that decompression, until the pressure falls to 280 mm., does not alter the respiratory quotient during rest. The *apparent* respiratory debit (volume expired measured at the actual pressure and temperature) remains normal, but the *real* volume (measured at 0° and 760 mm.) diminishes with the pressure. The total quantity of carbon dioxide expired varies but little.

W. D. H.



**Disappearance of Ethers in the Blood in Vitro.** By MAURICE DOYON and ALBERT MOREL (*Compt. rend.*, 1902, 135, 54—56).—The ethereal extract of the serum does not, under aseptic conditions, decrease on keeping at 37°, but that of the whole blood does diminish; there is, however, no appearance of equivalent quantities of free fatty acids or of glycerol. The amount of free organic acid does increase slightly. The action is therefore not a lipolytic one. W. D. H.

**Does Lipase Exist in the Blood?** By MAURICE DOYON and ALBERT MOREL (*Compt. rend.*, 1902, 134, 1254—1255).—The non-existence of lipase in the blood is shown by experiments similar to those used in previous experiments with serum (this vol., ii, p. 464); that is to say, no diminution of alkalinity occurs when the blood (of dog) is mixed with oil and sodium carbonate. It is, however, necessary that such experiments should be conducted aseptically.

W. D. H.

**Lipase in the Blood.** By MAURICE HANRIOT (*Compt. rend.*, 1902, 134, 1363—1365. Compare Abstr., 1901, ii, 562).—The correctness of statements of Doyon and Morel (see preceding abstract) is admitted, but the non-saponification of oil added to the blood is not regarded as proving the non-existence of lipase.

W. D. H.

**Gastric Digestion in New-born Dogs.** By W. GMELIN (*Pflüger's Archiv*, 1902, 90, 591—616).—The stomach of new-born dogs contains neither pepsin nor rennin. These ferments appear together about the eighteenth day of life, and increase in amount and activity as the principal cells of the glands develop. The pancreatic juice also does not clot milk; this power appears at the same time as the gastric rennet. Trypsin, however, is present at birth, and is active; the size of the pancreas is relatively great in young animals.

In this early period, the acid in the gastric juice is lactic acid; this causes a flocculent precipitation of caseinogen. Hydrochloric acid appears later. When rennet first appears, it precipitates casein from dog's milk more readily than from cow's milk. Dog's caseinogen dissolves easily and completely in dilute lactic acid.

W. D. H.

**Digestion in the Small Intestine. (II.)** By FRIEDRICH KUTSCHER and JOHN SEEMANN (*Zeit. physiol. Chem.*, 1902, 35, 432—458).—In the intestinal wall during absorption, it is possible to discover extractives which give no biuret reaction, and which on treatment with boiling acids yield leucine. The dead intestinal wall is capable of self-digestion; in this it resembles other organs rich in leucocytes. The intestine secretes an enzyme which acts feebly on fibrin, but more strongly in deuterio-proteose. A direct measure of the intensity of deuterio-proteose decomposition can be obtained by the use of the polarimeter. The importance of the proteolytic enzyme (O. Cohnheim's erepsin) in the normal digestion of proteid nutriment is considered to be small.

W. D. H.

**The Presence of Erepsin in the Intestinal Juice of Dogs.** By SERGEI SALASKIN (*Zeit. physiol. Chem.*, 1902, 35, 419—425).—Cohn-

heim left the question open whether crespin acts intracellularly or is actually excreted in the succus entericus. The present research shows that it does occur in the juice in dogs. The idea, which originated with Cohnheim, and was confirmed by Kutscher and Seemann, that proteid is absorbed in the form of simple products is supported. The recent work of Glaessner, who supported Hofmeister's doctrine that 'regeneration of albumin' is the result of synthesis of proteoses and peptone, is criticised.

W. D. H.

**Proteid Digestion and Absorption in Octopods.** By OTTO COHNHEIM (*Zeit. physiol. Chem.*, 1902, 35, 396—415).—Proteid digestion in octopods yields the same products as in mammals. The blood, even during full digestion, does not contain these products; the only nitrogenous substance there is hæmocyanin. Proteid is absorbed wholly as simple products of its decomposition (leucine, tyrosine, lysine, arginine, ammonia). It is probable that the same is true for vertebrate animals also.

W. D. H.

**Mechanism of Intestinal Absorption in Octopods.** By OTTO COHNHEIM (*Zeit. physiol. Chem.*, 1902, 35, 416—418).—The study of absorption, especially of sodium iodide in octopods, lends support to the doctrine of cellular activity as opposed to mere physical diffusion. The process occurs through the intestinal wall. The liver of these animals does not participate in the process of absorption.

W. D. H.

**Formation of Sugar in the Liver during Perfusion of Blood through it.** By FRIEDRICH KRAUS, jun. (*Pflüger's Archiv*, 1902, 90, 630—634).—Increase of sugar occurs in the blood perfused through a dog's liver, especially if the liver contains much glycogen. It does not matter whether a solution of Witte's peptone is mixed with the blood or not. No change is noticeable in the proteoses or peptone if this mixture is used.

W. D. H.

**Human Bile.** By J. BRAND (*Pflüger's Archiv*, 1902, 90, 491—522).—Analyses are given of human fistula bile from nine cases of operation. The results are compared in tabular form with those previously recorded. The daily quantity varies from 500 to 1100 c.c., but the flow varies also from hour to hour; it falls in the night, reaches a minimum in the early morning, then rises and reaches a maximum soon after midday; sometimes a second maximum occurs in the evening. If the fistula is incomplete, the bile contains more solid material; this is explained by absorption of the bile salts in the duodenum, and re-secretion by the liver. The bile is also thickened by secretions of the bile-passages. The percentage of solids varies from 1 to 4 for fistula bile to 20 for bladder bile. The amount of organic constituents varies with the total metabolism. It is suggested that normal liver bile might be obtained by administering as much bile salts into the intestine daily as is lost by the fistula. The colouring matters of human bile are bilirubin, urobilinogen, and hæmatoporphyrin (in some cases). The reaction is neutral or alkaline; this

depends on, but is not quite parallel to, the mucous secretion. Sulphur in the form of ethylsulphuric acid is present to the extent of 6.4, and in the form of taurocholate to the extent of 11.7 per cent. of the solids (0.00077 and 0.0015 per cent. respectively of the fluid bile). Once taurocholic acid was absent; in the other cases, the relation of sodium taurocholate to glycocholate varied from 1 to 4.5—5.4. The molecular concentration of both fistula and bladder bile is about equal to that of the blood; the more concentrated bile contains larger molecules of specific bile constituents and less inorganic salts. In the gall-bladder and bile ducts, a saline solution isotonic with blood is absorbed, and mucin molecules were exchanged for salt molecules. A high percentage of mucin is usually associated with a high percentage of salts; the reason of this is not clear. Bile conducts electricity better than the blood on account of its higher percentage of salts (including organic salts).

W. D. H.

**The Bile of the Isabella Bear.** By LEO VON ZUMBUSCH (*Zeit. physiol. Chem.*, 1902, 35, 426—431).—Some details of the character of this animal are given in order to compare them with the results obtained by Hammarsten on the bile of the polar bear. The presence of most of the usual constituents of bile is affirmed. The bile acid, however, comes nearest in its composition to the cholic acid of Lassar-Cohn.

W. D. H.

**The Circulation of the Bile Acids.** By ALFRED C. CROFTAN (*Pflüger's Archiv*, 1902, 90, 635—639).—The bile acids which circulate in the blood are not discoverable in either the red corpuscles or the serum. It is believed that they are combined with the leucocytes; this is supported by the ease with which they can be detected in the leucocyte-rich fluid of the thoracic duct. Small quantities of bile acids in the blood act cytolytically, influence coagulation-time, and are cholagogues and vaso-dilatators. Whether they act under physiological conditions in any or all of these ways is uncertain.

W. D. H.

**Is Alcohol a Food or a Poison?** By KASSOWITZ (*Pflüger's Archiv*, 1902, 90, 421—460).—The paper contains a good deal of controversial matter, and an account of experiments of a metabolic kind. The practical conclusion drawn is that alcohol is a poison, not a food, and should never be employed either in health or sickness.

W. D. H.

**A New Proteid from the Brain.** By C. ULPANI and G. LELLI (*Gazzetta*, 1902, 32, i, 466—473).—The authors have separated from horse's brain a substance which they find to be a compound of protagon and paranuclein. Until broken up by alcohol, the compound does not yield protagon when treated with chloroform, which readily dissolves it in the free state.

T. H. P.

**Auto-regulation of "Energetic" Functions by Carbon Dioxide.** By RAPHAEL DUBOIS (*Compt. rend.*, 1902, 135, 58—60).—Carbon dioxide is not to be regarded as a mere excretion, but as an antidote to oxygen, restraining various 'energetic' functions.

W. D. H.

**Formation of Glycogen.** By OSCAR SIMON (*Zeit. physiol. Chem.*, 1902, 35, 315—323).—Those proteids which contain a carbohydrate radicle are capable of acting as parent substances of glycogen. The opinion, however, has been expressed that possibly other parts of the proteid complex might be converted into carbohydrate, and some rather contradictory experiments with leucine suggest that it may play this rôle. To test this question, the present experiments on rabbits were undertaken; the animals were rendered glycogen-free by means of strychnine, but subsequent administration of leucine never led either directly or indirectly to the formation of glycogen in either the liver or the muscles.

W. D. H.

**The Synthesis of Hippuric Acid in the Animal Organism.** By E. BASHFORD and W. CRAMER (*Zeit. physiol. Chem.*, 1902, 35, 324—326).—Bunge and Schmiedeberg were the first to show that the synthesis of hippuric acid from glycine and benzoic acid was accomplished by the kidney cells. The present experiments show that in the presence of oxygen at high pressure the same synthesis is accomplished by the thoroughly disintegrated and crushed kidney. The action is therefore not dependent on the life of the kidney cells, but is of a chemical nature. Whether it is the expressed juice that has this action, or whether the presence of red corpuscles as oxygen carriers is essential, are points not yet settled.

W. D. H.

**Human Semen.** By B. SLOWTZOFF (*Zeit. physiol. Chem.*, 1902, 35, 358—363).—The ash and dry residue in human semen are fairly constant; the amount of proteid averages 2.26 per cent. The proteids present are nucleo-proteid, mucin, albumin, and a substance with the characters of a primary proteose. The high percentage of calcium and phosphoric acid explains the frequent occurrence of calculi of calcium phosphate in the prostate.

W. D. H.

**Composition of Sheep's Milk.** By AUGUSTE TRILLAT and FORESTIER (*Compt. rend.*, 1902, 134, 1517—1519).—The milk of the sheep is richer in caseinogen, fat, and ash than that of the cow. The following table gives in percentages the mean of the analyses; the character of the soil is also given:

	Granitic.	Schistose.	Clay and chalk.	Chalk.
Butter.....	7.40	7.42	6.98	7.18
Lactose .....	5.37	5.35	5.53	5.26
Caseinogen .....	6.18	5.87	5.54	5.12
Ash.....	1.02	0.93	0.96	1.02
Lime ...	0.25	0.26	0.25	0.24
Acidity .....	3.70	3.00	2.66	2.8

W. D. H.

**Influence of Choline on Secretions.** By ALEXANDRE DESGREZ (*Compt. rend.*, 1902, 135, 52—54).—Choline is not a mere excretion. In addition to its favourable action on metabolism, it, like pilocarpine, provokes an increase in the secretion of saliva, pancreatic juice, bile, and urine. This is attributed to its trimethylamine group.

W. D. H.



**Oxalic Acid in Urine.** By WILHELM AUTENRIETH and HANS BARTH (*Zeit. physiol. Chem.*, 1902, 35, 327—342).—The best method for estimating oxalic acid in urine, fæces, or organs is a combination of precipitation and extraction processes, which is described in full. Oxalic acid is a normal and probably constant constituent of human urine; the opposite statement is due to the use of imperfect methods. The greater part of the acid is formed in the organism. Among pathological conditions, tubercle of the lungs and peritoneum and pernicious anæmia are those in which the formation of oxalic acid was found to be specially increased. In the rabbit, if oxalic acid is given, it is completely, or almost completely, burnt in the body.

W. D. H.

**Suprarenal Diabetes.** By FRITZ BLUM (*Pflüger's Archiv*, 1902, 90, 617—629).—The suprarenal bodies contain a substance injection of which into the blood-stream leads to glycosuria. The substance which produces this effect is believed to be identical with the reducing substance which raises blood-pressure. Von Fürth's suprarenin and Parke-Davis' adrenalin produce the effect. The character of the glycosuria resembles that produced by medullary puncture, so that the suprarenal substance possibly acts through the liver. The relationship of this condition to human diabetes is discussed; so also is the question whether the suprarenal forms an internal secretion or removes toxic material from the body; the author inclines to the latter view.

W. D. H.

**Physiological Action of Extracts of Kidney.** By ERNEST GÉRARD (*Compt. rend.*, 1902, 134, 1248—1250).—Aqueous extracts of kidney have been shown by Gonnermann to be capable of hydrolysing certain anides and anilides. In the present research, the kidney was first freed from blood, and therefore it is shown that the hydrolysing agents come, not from the blood, but from the renal tissue. The hydrolytic action was shown to take place with glycogen, guaiacol, oxaluric acid, and lactose, but not with starch and inulin. The action is destroyed by boiling the extract; the precipitate produced by alcohol has the same action as the original extract.

W. D. H.

**Action of Lecithin on the Animal Organism.** By ALEXANDRE DESGREZ and ALY ZAKY (*Compt. rend.*, 1902, 134, 1522—1523. Compare *Abstr.*, 1901, ii, 518).—It is the base choline to which lecithin owes its property of retarding the elimination of phosphoric acid. Betaine also possesses, although to a less degree, the power of favourably influencing the elaboration of nitrogenous matters and the weight of the organism.

W. D. H.

**Properties and Nature of Mixtures of Toxins with their Antitoxins.** By T. DANYSZ (*Ann. Inst. Pasteur*, 1902, 16, 331—345).—Experiments with solutions of ricine and an antiricine serum obtained from the goat show that mixtures of minimum activity are not completely indifferent, but possess slight antitoxic or toxic properties, and sometimes are at the same time both toxic and anti-

toxic. The composition of the mixture of minimum activity differs for different animals. A mixture of minimum activity does not spontaneously become active, but may be rendered active by an agent which will destroy one constituent but not the other. Ricine is much less acted on than antiricine by both gastric and pancreatic juice, and hence mixtures of minimum activity are rendered active by digestion. It seems probable that the toxin and antitoxin do not form a single compound, but unite in different proportions to form a series of compounds. Neither of the constituents is destroyed in the process of combination.

A. H.

**Venom of the Common Toad.** By C. PHISALIX and GABRIEL BERTRAND [*Compt. rend.*, 1902, 135, 46—48. By G. BERTRAND (*ibid.*, 49—51)].—The venom is best obtained by squeezing it out from the glands. If an alcoholic extract of the whole skin is made, all the poisonous substances pass into solution, but these are mixed with other materials. The toxic action is due to two principal substances; one, named *bufotalin*, is of resinoid nature; it is soluble in alcohol, and slightly so in water; it arrests the frog's heart in systole. The other, termed *bufotenin*, is very soluble in both water and alcohol; it has a paralysing influence. The substance *bufonin*, described by Faust, is extracted from the skin; it is merely cholesterol mixed with a little bufotalin.

W. D. H.

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## Chemistry of Vegetable Physiology and Agriculture.

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**Variations in the Products formed by Pathogenic Bacteria.** By ALBERT CHARRIN and A. GUILLEMONAT (*Compt. rend.*, 1902, 134, 1240—1243).—The soluble products of certain bacteria (*B. pyocyaneus*), when injected intravascularly, cause immediate death, whilst those of other microbic agents (for instance, *B. tetanus*, *B. diphtheria*) do not. The extreme toxicity is due, not to the pigments produced (these are not markedly poisonous), but to certain volatile compounds which are accessory to the true toxins. These volatile substances no doubt lower the resistance of the organism, so that it is more readily influenced by the toxins. The hæmolytic substances produced by one variety of bacillus are multiple; and, further, the numerous products are to some extent antagonistic towards each other.

W. D. H.

**Nitrification in Different Soils.** By W. A. WITHERS and GEORGE S. FRAPS (*J. Amer. Chem. Soc.*, 1902, 24, 528—534. Compare Abstr., 1901, ii, 523).—The extent of nitrification of ammonium sulphate and cotton-seed meal in various soils, without and with addition of calcium carbonate, was determined. The conditions of moisture and temperature were known and the time was about three weeks.

As lending support to the view that ammonium sulphate hinders nitrification, it is mentioned that nitrification became more rapid when the amount of ammonium sulphate was reduced. The presence of calcium

carbonate was always beneficial, especially with ammonium sulphate. In some cases it was found that ammonium sulphate and in others that cotton-seed meal was the more rapidly nitrified. This is attributed to differences in the nitrifying microbes in the various soils. This view, although opposed to the prevailing opinion (Omeliensky, Abstr., 1900, ii, 97) that organic nitrogen has to be converted into ammonia before being nitrified, is in accordance with the results showing that the nitrous organism nitrifies organic nitrogen.

Continued application to limed soils of ammonium sulphate increases its power of nitrifying ammonium sulphate. N. H. J. M.

**Aërobic Fermentation of Farmyard Manure.** By C. DUPONT (*Ann. Agron.*, 1902, 28, 289—317).—*Bacillus mesentericus ruber* and *B. thermophilus Grignoni* are both oxidising bacteria which effect the combination of nitrogenous substances and carbohydrates; they produce carbon dioxide in large quantities and traces of volatile acids. The former is very active above 55° and can be cultivated in all media, even in absence of nitrogen; it attacks sugar and starch, and acts violently on proteids, with production of ammonia and liberation of some free nitrogen.

*B. thermophilus Grignoni* can exist at relatively very high temperatures. Its oxidising action resembles that of *B. mesentericus ruber*, except that it rarely produces ammonia from proteids.

Farmyard manure is very favourable to the growth of *B. mesentericus ruber*, which soon becomes the predominating microbe. As, however, the temperature rises its activity diminishes and it gives place to *B. thermophilus*, which will live at 70°. N. H. J. M.

**Production of Hydrogen Sulphide in Alcoholic Fermentation.** By M. EMM. POZZI-ESCOT (*Bull. Soc. Chim.*, 1902, [iii], 27, 692—693).—From experiments on the production of hydrogen sulphide during fermentation in the presence of sulphur, the author finds that the reducing diastases are not set free until after the fermenting power has attained its maximum and the yeast ceases to grow freely.

A. F.

**Influence of Thiocyanic Acid on the Growth of *Aspergillus Niger*.** By AUGUSTE FERNEBACH (*Compt. rend.*, 1902, 135, 51—52).—The addition of ammonium thiocyanate to Raulin's solution (0.1 to 0.5 gram per litre) does not prevent the growth of *Aspergillus niger*, but retards fructification, which does not take place until all the thiocyanate has been decomposed. C. H. B.

**Mode of Utilisation of Ternary Nourishment by Plants and Micro-organisms.** By PIERRE MAZÉ (*Ann. Inst. Pasteur*, 1902, 16, 195—232).—From a number of experiments on the germination of seeds, the conclusion is drawn that the carbohydrate reserve is first fermented to alcohol and carbon dioxide, and that the alcohol is then utilised for the production of tissue and the life of the seedling.

Thus when peas are exposed under water, in the absence of free oxygen, alcohol and carbon dioxide are produced, but no fresh living substance is produced; in the presence of oxygen, however, the alcohol is utilised for the production of ternary tissue. The fats of the seeds

are probably first converted into carbohydrates by absorption of oxygen, and these carbohydrates are then fermented in the same manner as those which occur in the seeds. A. H.

**Mode of Utilisation of Tertiary Carbon by Plants and Micro-organisms.** By PIERRE MAZÉ (*Ann. Inst. Pasteur*, 1902, 16, 346—378. Compare preceding abstract).—One of the ascomycetes, *Eurotysopsis Gayoni*, ferments sugars quite as readily as yeast and at the same time grows in a medium containing only mineral substances (including ammonium salts) and alcohol. A comparison of the modes of growth in solutions of dextrose and of alcohol shows that these are identical in principle and that in both cases it is the alcohol which is the primary compound assimilated. It seems probable, however, that it is not assimilated in this form, but is first oxidised with formation of aldehyde, which is then directly taken up by the protoplasm of the cells. A. H.

**Chlorophyll Assimilation.** By R. O. HERZOG (*Zeit. physiol. Chem.*, 1902, 35, 459—464).—Extracts crushed from green leaves in the same way as Buchner employed in making his extracts of yeast have no power to absorb carbon dioxide and give out oxygen. This confirms Engelmann's statement that this power of green plants depends on the chlorophyll granules being intact. W. D. H.

**Cyanogenesis in Plants. Part II. The Great Millet, *Sorghum vulgare*.** By WYNDHAM R. DUNSTAN and THOMAS A. HENRY (*Proc. Roy. Soc.*, 1902, 70, 153—154).—When young plants of *Sorghum vulgare* are crushed with water, hydrogen cyanide is produced (about 0.2 per cent. of the dried plant), owing to the action of a hydrolytic enzyme, apparently identical with emulsin, on a glucoside.

This glucoside, *dhuririn*,  $\text{OH} \cdot \text{C}_6\text{H}_4 \cdot \text{CH}(\text{CN}) \cdot \text{O} \cdot \text{C}_6\text{H}_{11}\text{O}_5$ , crystallises readily and is soluble in alcohol or water. When hydrolysed by emulsin or dilute acids, it yields *p*-hydroxybenzaldehyde, dextrose, and hydrogen cyanide. If the glucoside is warmed with alkali hydroxide, it is converted into ammonia and *dhurinic acid*; the acid, when heated with dilute hydrochloric acid, undergoes hydrolysis with formation of *p*-hydroxymandelic acid and dextrose. E. G.

**Analysis of Piper Famechoni or Kissi Powder.** By A. BARILLÉ (*Compt. rend.*, 1902, 134, 1512—1514).—The analysis of Kissi powder from Haute-Guinée (Africa) gave the following percentages :

Water.....	14.604	Proteids.....	10.253
Ash { soluble (3.61) }	4.550	Alcoholic extract .....	19.250
{ insol. (0.94) }		Aqueous extract .....	16.076
Volatile oil.....	4.470	Tannin .....	0.260
Piperine .....	3.654	Gummy, pectic, colour-	
Starch.....	38.004	ing, and nitrogenous	
Cellulose.....	10.009	matters .....	5.275
Dextrose .....	5.208	Resin, fixed oil .....	3.995
Sucrose .....	1.663	Total nitrogen .....	1.820

The powder is useful as a spice and condiment.

J. McC.



**Studies on the Feeding of Milch Cows and on the Relations of Milk Fat to Food.** By WHITMAN H. JORDAN, C. G. JENTER, and F. D. FULLER (*Bied. Centr.*, 1902, 31, 465—475; from *New York Agric. Exper. Stat. Bull.*, No. 197, 1901).—As regards the origin of milk fat, the conclusion is drawn that it is produced, at least in part, from carbohydrates. Increased, or, within certain limits, decreased amounts of proteids in the foods have no direct effect on milk production, but only result more or less in the decomposition of the digestible protein.

The heat value of urine is shown to have no relation to the amount of nitrogen. The value cannot be estimated, but should be determined in each case.

The distribution and utilisation of the heat value of food in milk production is as follows:—More than 40 per cent. of the available heat value is used for maintenance, whilst more than 30 per cent. goes to the solid constituents of the milk. The remaining quarter or fifth of the heat value is available for promoting the milk secretion.

N. H. J. M.

**Study of Rations Fed to Milch Cows in Connecticut.** By C. S. PHELPS (*Storr's Agric. Exper. Stat. 13th Ann. Rep.*, 1901, 130—157).—The experiments were made with four herds (two series each), and covered periods of 11—12 days. In the first series, the food was essentially the same for each cow, whilst in the second series the food was varied according to the yields of butter fat. Cows which yielded in the first series 50—65 lb. of butter fat received in the second series the basal ration only; whilst cows which had yielded 66—80 lb., 81—95 lb., and 95—100 lb. of fat in the first series received in addition to the basal ration respectively 1, 2, and 3 lb. of protein mixture, containing about 30 per cent. digestible protein.

The results illustrate the economy of feeding a larger proportion of protein than is usual. Rations supplying 1·80 to 2·60 lb. of digestible protein per day were generally more remunerative than those containing less protein.

N. H. J. M.

**Experiments on Feeding Pigs with Sugar, Rye Bran, and Meat Meal.** By J. KLEIN (*Bied. Centr.*, 1902, 31, 534—539; from *Milchzeit.*, 1901, *Heft* 6, 7, and 8).—Whilst sugar, rye bran, and meat meal were without injurious effect on the fat of pigs, meat meal had a marked effect on the flesh; the effect was, however, less than is sometimes stated.

N. H. J. M.

**Keeping Properties and Storage of Molasses Foods.** By BERNHARD SCHULZE (*Bied. Centr.*, 1902, 31, 539—546; from *Arch. deut. landw. Ges.*, 1901, *Heft* 59).—The liability of molasses foods to decompose increases with the amount of water. There may be a very serious loss of sugar and the cane sugar becomes inverted. Peat molasses undergoes no essential change unless the percentage of water is high; the amount of water should not exceed 30 per cent.

In preparing the foods, the molasses should be concentrated as much as possible, and addition of water is to be avoided.

N. H. J. M.

**Effect of Calcium Carbonate in the Soil on the Development of Leguminous Plants in Pots.** By BERNHARD SCHULZE (*Bied. Centr.*, 1902, 31, 455; from *Jahresber. agrik.-chem. Versuchs-Stat. Breslau*, 1900).—The soil was fully manured and received, in addition, 0.1—5.0 per cent. of pure calcium carbonate. The plants grown were peas, beans, vetches, and red clover.

On the whole, 1 per cent. of carbonate gave the best results, but the yields in the pots which had 5 per cent. were almost as good.

N. H. J. M.

**Pot Experiments on the Manurial Requirements of Silesian Soils.** By BERNHARD SCHULZE (*Bied. Centr.*, 1902, 31, 436—437; from *Jahresber. agrik.-chem. Versuchs-Stat. Breslau*, 1900).—The results of pot experiments showed in every case a very marked deficiency of phosphoric acid in the soils.

N. H. J. M.

**After Effect of Ammonium Sulphate.** By E. KLOEPFER (*Bied. Centr.*, 1902, 31, 438—440; from *Fühling's landw. Zeit.*, 1901, 154).—Oats were grown in 1900 on the experimental plots which had grown roots and potatoes (without and with ammonium sulphate) in 1899. In every case, the yield of oats was greater on the plots which received nitrogen in 1899 than on the others.

N. H. J. M.

**Effect of Straw, Peat, and Cow Dung, &c., on the Action of Nitrogen as Nitrates.** Alinit. By MAX GERLACH (*Bied. Centr.*, 1902, 31, 435—436; from *Jahresber. Landw. Versuchs-Stat. Posen*, 1900—1901).—Addition of straw considerably reduced the effect of nitrates. Peat, when applied with nitrates, reduced grain production and increased straw production. Cow dung, with straw and nitrates, had almost no effect.

The application of carbon disulphide, in addition to straw and cow dung, resulted in a considerably increased growth.

Negative results were obtained with alinit.

N. H. J. M.

**Effect of Soil Moisture on the Action of Bone-meal as compared with Basic Slag and Superphosphate.** By CONRAD VON SEELHORST (*J. Landw.*, 1902, 50, 167—174).—The results of pot experiments on oats and clover showed that whilst the amount of water in the soil was without effect in the case of bone meal, an increased amount of water in the soil increased the activity of basic slag and superphosphate.

N. H. J. M.

**The Time for Manuring Peaty Meadows, especially with Potassium Salts.** By BRUNO TACKE (*Bied. Centr.*, 1902, 31, 507—509; from *Mitt. Ver. Förd. Moorkultur. Deut. Reiche*, 1902, 1).—Potassium salts should be applied when vegetation is dormant, rather than soon after the commencement of new growth, unless serious loss of potassium is to be feared, as when the meadows are flooded.

Forty per cent. potassium salts gave better results than kainite when applied in the spring, owing to the solution being less concentrated.

N. H. J. M.

**Value of Forty per cent. Potassium Salts as compared with Kainite.** By MAX MAERCKER and W. SCHNEIDEWIND (*Bied. Centr.*, 1902, 31, 505—507; from *Arb. deut. landw. Ges.*, 1902, Heft 67).—The results of field experiments on cereals, grown in both heavy and light soils, showed that kainite gave more satisfactory results than 40 per cent. potassium salts. In the case of potatoes, potassium salts gave the better results, both as regards the yield of tubers and starch production. The percentage amount of starch was lowered by potassium salts, but less than by kainite. Potassium sulphate gave very good results with potatoes.

In the case of high per cent. sugar beet, potassium salts are preferable to kainite, in the case of good soils, as larger amounts of potassium can be applied without injuring the mechanical properties of the soil.

N. H. J. M.

**Plot and Pot Experiments on the Value of Different Potassium Manures.** By BERNHARD SCHULZE (*Bied. Centr.*, 1902, 31, 449—453; from *Jahresber. agrik.-chem. Versuchs-Stat. Breslau*, 1900).—Potassium chloride considerably increased the yield of clover, whilst the yields with kainite and potassium sulphate were rather less than without manure. The crop contains, however, in each instance more potassium than when no manure was applied, especially in the case of potassium chloride. Potassium sulphate gave the least satisfactory results.

Pot experiments are described in which white mustard, oats, peas, and sugar beet were manured with the same amounts of potassium in different forms. The following percentage amounts of potash were utilised by the plants:

	Beet.	White Mustard.	Oats.	Peas.	Mean.
Kainite .....	22.1	20.0	11.0	20.0	18.0
Potassium sulphate...	43.9	60.0	29.0	60.0	48.0
„ „ chloride...	48.0	54.0	33.0	69.0	51.0

N. H. J. M.

**Manurial Experiments with Potassium on Sugar Beet in 1900.** By AUMANN (*Bied. Centr.*, 1901, 31, 447—449).—The results of experiments made near Hildesheim showed that about half the land required potash. Kainite gave better results when applied three times than when the whole was applied at the same time. The highest yield of sugar was obtained after manuring with 40 per cent. potassium salts.

N. H. J. M.

**Pot Experiments on the Action of Lime and Magnesia in Burnt Lime and Marls.** By RICHARD ULBRICHT (*Landw. Versuchs-Stat.*, 1902, 57, 103—166. Compare Abstr., 1900, ii, 240).—The experiments now described were made with barley. Whilst application of lime increased the yield, the weight of the grain was diminished by lime and marl (applied in February); the number of ears was increased.

Large amounts of magnesia lower the yield of grain, and still larger amounts the yield of straw as well. N. H. J. M.

Utilisation of Calcium Carbide Residues in Agriculture. By MAX GERLACH (*Bied. Centr.*, 1902, 31, 511—514; from *Fühling's Landw. Zeit.*, 1902, 81).—The material employed contained: water, 49.52; calcium hydroxide, 40.69; calcium carbonate, 7.33; insoluble in hydrogen chloride, 0.43 per cent. Traces of potassium and nitrogen were found, but no phosphoric acid. As a manure, its action resembles that of lime. N. H. J. M.

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## Analytical Chemistry.

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New Reagent for the Detection of Ozone. By GRIGORI V. CHLOPIN (*Zeit. Nahr.-Genussm.*, 1902, 5, 504—505).—Strips of ordinary filter-paper are dipped in a moderately concentrated alcoholic solution of a dye, sold under the name of "Ursol D," and dried. When moistened with water and exposed to the action of ozone, the strips are coloured blue. Hydrogen peroxide has no action on the test-papers, whilst nitrous fumes, chlorine, and bromine give a bluish-green coloration, soon changing to yellow. Carbon dioxide also has no action on the papers. The test-papers should be freshly prepared for use. W. P. S.

Detection and Estimation of Minute Quantities of Hydrogen Sulphide in Coal-gas. By WILLIAM J. DIBDIN and ROBERT GEORGE GRIMWOOD (*Analyst*, 1902, 27, 219—223).—Of all the reagents employed, dry lead acetate papers were found to afford the most sensitive means for detecting almost infinitesimal traces of hydrogen sulphide in coal-gas. To ascertain the smallest amount which could be detected, a known volume of hydrogen sulphide was introduced by means of a capillary tube into a large glass reservoir holding 15,500 c.c. of coal-gas. When diffusion had taken place, a toy balloon in the reservoir was partially inflated, causing some of the contaminated gas to pass into a bell-jar containing the strip of lead paper. The rate of flow of the gas was half a foot per hour, and, by diluting down the contents of the reservoir with fresh coal-gas, it was found that, within a reasonable time, 1 volume of hydrogen sulphide could be detected in 1,000,000,000 of coal-gas, or 1 grain in 600,000 cubic feet of gas. By regulating the distance of the lead paper from the nozzle and passing the gas at the rate of half a foot per hour, it was found that the time required for the production of a colour was constant for that proportion at that distance. Comparison of the colorations produced was not possible owing to the evanescent nature of the colour spot. W. P. S.

Estimation of Uncombined Sulphur Dioxide in Fermented Beverages. By MATHIEU and BILLON (*Ann. Chim. anal.*, 1902, 7, 252—256).—The total sulphur dioxide is estimated by de Haas'



distillation method. The combined sulphur dioxide (that in combination with aldehydes) is then estimated, the difference representing the free sulphur dioxide.

The combined acid is estimated as follows: 100 c.c. of the sample (wine, beer, cider, &c.) are introduced into de Haas' apparatus, previously filled with carbon dioxide: 2 c.c. of hydrochloric acid are added, and then a sufficiency of  $N/50$  iodine; the exact amount necessary has been previously determined by adding the solution to 10 c.c. of the sample until a drop gives a decided reaction with starch. The iodine at once oxidises the free sulphur dioxide, but does not act on the combined acid in the cold; further action, however, is prevented by adding a corresponding amount of sodium arsenite. The liquid is now submitted to distillation, the distillate being received into an excess of iodine solution, and the sulphuric acid thus formed is then estimated and calculated to sulphurous acid.

As a check, the sulphates in the residue of the distillation in de Haas' and the authors' methods may be estimated. The difference represents the free sulphurous acid.

L. DE K.

**Detection of Nitrates in the Presence of Alkali Ferro- and Ferri-cyanides.** By AUGUSTE F. LEUBA (*Ann. Chim. anal.*, 1902, 7, 258).—The solution is freed from ferro- or ferri-cyanide compounds by precipitating with a solution of cadmium chloride. To the filtrate, the usual test for nitrates with ferrous sulphate and sulphuric acid is then applied; it may also be tested for nitrites.

L. DE K.

**Apparatus for the Analysis of Calcium Carbide.** By CARLO FORMENTI (*Chem. Centr.*, 1902, i, 1341; from *Boll. Chim. Farm.*, 41, 209—302).—About 3—5 grams of the calcium carbide are introduced into a weighed flask in which is placed a tube containing about 4 c.c. of brine; the flask is fitted with a calcium chloride tube and a bent tube reaching to the bottom. After weighing, the flask is slightly inclined so as to allow the brine to fall on to the carbide. When evolution of gas ceases, dry air is drawn through the apparatus, which is then reweighed; the loss represents acetylene.

L. DE K.

**Simple Method for the Estimation of Iron in Metabolism Experiments.** By ALBERT NEUMANN (*Chem. Centr.*, 1902, i, 1422—1423; from *Arch. Anat. Phys.* [His-Engelmann] *Physiol. Abt.*, 1902, 362—365. Compare this vol., ii, 176).—The solution obtained as previously directed is mixed with 20 c.c. of a reagent prepared by precipitating a solution containing 25 grams of zinc sulphate with one containing 100 grams of disodium hydrogen phosphate, dissolving the precipitate by addition of dilute sulphuric acid, and diluting to 1 litre. Ammonia is now added until the precipitate has nearly all redissolved and the solution is then boiled; the crystalline zinc precipitate carries down every trace of iron. The precipitate is washed by decantation, dissolved in hydrochloric acid, and after neutralising the excess of acid with ammonia the iron is titrated as usual by means of potassium iodide and  $N/250$  thiosulphate solution.

When dealing with liquids such as urine, it is now recommended to first add one-tenth volume of strong nitric acid and then gradually drop 100 c.c. of the mixture into 30 c.c. of boiling nitric acid; after evaporating to 50 c.c., the usual mixture of nitric and sulphuric acids is added and the operation conducted as before.

L. DE K.

**New Method for the Precipitation and Separation of Thorium Earths.** By A. KOLB (*J. pr. Chem.*, 1902, [ii], 66, 59—64).—Thorium is precipitated from a solution of its chloride or nitrate by water saturated with aniline, whilst the chlorides or nitrates of cerium, lanthanum, didymium, yttrium, and erbium are not precipitated. Any colouring matter (from the aniline) which the precipitate contains can be removed by ignition.

R. H. P.

**Estimation of Vanadium.** By H. CORMIMBŒUF (*Ann. Chim. anal.*, 1902, 7, 258—260).—A modification of Roscoe's method. The alkaline solution containing the vanadic acid is acidified with acetic acid and precipitated with lead acetate, and the precipitate is collected on a tared filter, washed with water containing a little acetic acid, dried at 100°, and weighed. As it contains a slightly variable amount of lead, it is removed from the filter, and after having been well mixed in a mortar, an aliquot part is dissolved in water containing a little nitric acid and the lead is precipitated by adding sulphuric acid. (In Roscoe's original process, the lead sulphate is weighed, calculated to lead oxide, and deducted from the lead vanadate, the difference being vanadic acid.) The filtrate is evaporated in a weighed porcelain dish, and the residue gradually heated to expel the sulphuric acid, and finally heated to redness; the vanadic acid is then obtained as a partially fused mass.

L. DE K.

**Estimation of Organic Nitrogen in Water.** By HENRI CAUSSE (*Compt. rend.*, 1902, 134, 1520—1522).—The method of estimating the nitrogen is as follows:—25 c.c. of a saturated solution of barium hydroxide containing 20 per cent. of barium chloride are added to a litre of water and the mixture is left for one day. The precipitate which forms is collected and washed, then mixed with twice its volume of a 10 per cent. solution of potassium carbonate, and heated on the water-bath for 20—25 minutes. The clear liquid is decanted through a filter, and the residue treated again in the same way with half the quantity of the potassium carbonate solution. The filtrates are united and made acid with sulphuric acid, then evaporated to dryness. The dry residue is heated with 5 c.c. of sulphuric acid and the organic matter destroyed in the usual way. One hundred c.c. of distilled water are added and the liquid heated to boiling to expel the sulphur dioxide. After cooling, potassium hydroxide is added in excess and 25 c.c. are distilled off. The mixture is allowed to cool and another 25 c.c. are distilled off; the two fractions are united, made up to 100 c.c., and the ammonia determined by the Nessler method.

The author gives some results of the determination with Rhone water at different periods, and discusses the question of organic nitrogen and potability.

J. McC.

**Influence of Potassium Ferrocyanide on the Precipitation of Phosphoric Acid by Molybdate Solution.** By AUGUSTE F. LEUBA (*Ann. Chim. anal.*, 1902, 7, 257).—In the presence of ferrocyanide, a dense, reddish-brown precipitate is formed, completely obscuring the yellow phosphomolybdate precipitate. It is, however, readily soluble in a solution of sodium carbonate, and on carefully neutralising this with nitric acid and gentle warming, the yellow precipitate will duly appear. L. DE K.

**Estimation of Glycerol.** By SIMON ZEISEL and R. FANTO (*Chem. Centr.*, 1902, i, 1424—1425; from *Zeit. landw. Versuchs-Wes. Oesterr.*, 5, 729—745. Compare this vol., ii, 111).—The substance is distilled in a special apparatus with hydriodic acid containing from 57 to 63 per cent. of hydrogen iodide in a current of carbon dioxide. The vapours, cooled to 60°, are passed through a small wash-bottle containing amorphous phosphorus suspended in water at 60° to free them from iodine or hydrogen iodide. The isopropyl iodide formed by the action of the hydriodic acid on the free or combined glycerol is finally passed through a 4 per cent. alcoholic solution of silver nitrate, and the silver iodide formed is collected and weighed. Its weight multiplied by 0.3922 gives the amount of glycerol. L. DE K.

**Delicate Reaction for Dextrose and other Aldehydes.** By EM. RIEGLER (*Ann. Sci. Univ. Jassy*, 1901, 1, 256—258).—A solution of dextrose, treated with small quantities of phenylhydrazine hydrochloride and sodium acetate, is heated to boiling and rendered alkaline with sodium hydroxide solution; the mixture is then shaken several times and allowed to remain until a reddish-violet coloration is developed. This change takes place immediately if the solution contains more than 5 per cent. of the sugar, but in any case the coloration appears within 15 minutes, the colour being distinct even in 0.003 per cent. solutions. A sample of urine containing a pathological amount of dextrose should give the coloration in one minute at the latest.

Formaldehyde or acetaldehyde may also be detected in a similar manner by adding their solutions to a mixture of phenylhydrazine hydrochloride suspended in aqueous sodium hydroxide solution. A reddish-violet coloration is developed either by boiling or by prolonged agitation. The presence of formaldehyde in milk may be ascertained by this process. G. T. M.

**The Osazone Test for the Detection of Sugar in Urine.** By FRIEDRICH ESCHBAUM (*Chem. Centr.*, 1902, i, 1253; from *Apoth. Zeit.*, 17, 280—282).—Five drops of phenylhydrazine, 20 drops of acetic acid, and 50 drops of the suspected urine are boiled in a test-tube for just one minute in a fume chamber. A quantity of aqueous sodium hydroxide slightly less than is wanted for complete neutralisation is added, the mixture is again heated to boiling, and then allowed to cool. After some time, the clear liquid is decanted and the deposit examined microscopically for phenylglucosazone. This forms tufts of yellow needles; other crystalline forms are not characteristic for sugar.

0.025 per cent., and, in the absence of much uric acid, even 0.01 per cent. of dextrose may thus be detected. L. DE K.

**Estimation of Glycogen.** By EDUARD PFLÜGER (*Pflüger's Archiv*, 1902, 90, 523—524).—Glycogen purified by the Brücke-Külz method is rapidly decomposed by warming with dilute alkali. If, however, the glycogen is obtained without the use of mineral acids or Brücke's reagent, it can be heated for many hours with strong alkali without undergoing any change. If flesh containing glycogen is boiled with 30 per cent. potassium hydroxide, the same yield is obtained whether the boiling be continued for 1 or 24 hours. The material which has hitherto been termed glycogen is only a decomposition product of true glycogen, and the name pseudo-glycogen is suggested for it. Glycogen is obtained from flesh by precipitating it with alcohol from an alkaline extract containing potassium iodide. It is then boiled and inverted and the final estimation made by Volhard's method. Further details are promised. W. D. H.

**Estimation of the Tartaric Acid in Wines.** By LOUIS MAGNIER DE LA SOURCE (*Ann. Chim. anal.*, 1902, 7, 246—249).—The conventional (French) method is to determine the amount of potassium hydrogen tartrate after adding a little potassium bromide to the sample. In another portion of the sample, the existing potassium hydrogen tartrate is estimated, and the difference between the two determinations  $\times 0.8$  gives the amount of the free tartaric acid. This determination is made by one of three methods; (a) by mixing the sample with alcohol and ether; (b) by adding alcohol, ether, and tartaric acid; (c) by evaporation, preferably in a vacuum.

The author states that method (a) is utterly untrustworthy and has caused great discrepancies in wine analyses; (b) and (c), however, give trustworthy and concordant results. L. DE K.

**The Determination of Iodine Absorption by Means of Iodine Monochloride.** By J. J. A. WIJS (*Zeit. Nahr.-Genussm.*, 1902, 5, 497—504).—The solution of iodine monochloride in glacial acetic acid keeps well, provided that the purest acetic acid is employed. The presence of iodine trichloride, water, or traces of alcohol causes the solution to diminish in strength from day to day. Carbon tetrachloride should be used in place of chloroform, as the latter frequently contains alcohol. Ordinary Hübl's solution is similarly affected by the presence of water and aldehydes in the alcohol used in its preparation. When a 70 per cent. excess of iodine is employed, the results obtained by the use of iodine monochloride agree closely with those required by theory, especially in the case of unsaturated fatty acids having one double-linking. W. P. S.

**Analysis of Butter.** By A. KICKTON (*Zeit. Nahr.-Genussm.*, 1902, 5, 458—459).—Attention is drawn to the advisability of applying the phytosterol acetate test to butters which give a low Reichert-Meissl number and yield negative results with the usual tests for cotton-seed and sesamé oils. W. P. S.



**Estimation of Lecithin in Milk.** By FRED. BORDAS and SIG. DE RACZKOWSKI (*Compt. rend.*, 1902, 134, 1592—1594).—Stoklasa's method (*Abstr.*, 1897, ii, 573) of estimating lecithin in milk, which consists in determining the phosphoric acid present in the alcohol-ether extract of the dry residue of a given quantity of milk, and then multiplying by a factor to obtain the amount of lecithin, is shown in the first place only to hold approximately if the latter is regarded as present in the form of lecithin oleo-margarate; and secondly, incineration of the alcohol-ether extract with potassium carbonate and nitrate does not effect the complete conversion of the phosphorus into phosphate. The authors recommend an estimation of the phosphate, and hence a determination of the phosphoglyceric acid. The method employed is as follows: 100 c.c. of milk are added to a mixture of 100 c.c. of alcohol and 100 c.c. of water and 10 drops of acetic acid; the coagulum is collected and washed three times with 50 c.c. of boiling alcohol; this extract is evaporated to dryness and the residue taken up in alcohol-ether and then hydrolysed with potassium or barium hydroxide; the soap is decomposed by nitric acid, the fatty acid filtered off, and the phosphoglyceric acid in the filtrate oxidised to phosphate by concentrated nitric acid and permanganate; the phosphate is finally weighed as magnesium pyrophosphate; when the quantity of the latter is multiplied by the factor 1.5495, the amount of phosphoglyceric acid in 100 c.c. of milk is obtained.

K. J. P. O.

**Evaluation of Gelatin and Glues.** By ARTHUR MÜLLER (*Zeit. angew. Chem.*, 1902, 15, 482—487).—The process is briefly as follows:—Ten grams of the sample are soaked in water and finally dissolved by heating on the water-bath; after diluting to 500 c.c. with water at 30°, three separate portions of 10 c.c. are pipetted off, and to each are added 25 or 30 c.c. of tannin solution (3), and then, after vigorous stirring, 20 c.c. of alum solution (4). The precipitates are well washed with water at 30°. The three filtrates are then treated as follows: The first is mixed in a closed flask with 2 grams of hide powder and put away for 18 hours, when the liquid is passed through a filter and the hide powder well washed. The filtrate is then titrated by the method proposed by Gantter (*ibid.*, 1889, 517), as modified by Schroeder and Paessler (*Zeit. anal. Chem.*, 1890, 29, 698).

(This process differs from the ordinary permanganate process in so far that the permanganate solution (1) is allowed to act at boiling point; standard oxalic acid (2) is then added and the excess again titrated with permanganate.)

The second filtrate is mixed with 20 c.c. of dilute sulphuric acid (1:5) and titrated as described. The third portion is then titrated, 3 c.c. of acid being added for every 5 c.c. of permanganate consumed in the second titration. The difference between the result of the first and third titrations gives the amount of permanganate consumed by the excess of tannin only. The tannin solution (3) is also checked with permanganate; 5 c.c. of the solution and 12 c.c. of dilute sulphuric acid are titrated at boiling point with permanganate as described, and the operation is repeated with 5 c.c. previously treated with hide powder. By an easy calculation, it is found how much of the added

tannin has been precipitated by the gelatin. If the directions are scrupulously followed, 100 parts of pure tannin correspond with 139.1 parts of gluten. For isinglass, the figure lies between 144.6 and 145.

*Preparation of the Solutions.*—(1) 5.7469 grams of pure potassium permanganate are dissolved to 1 litre. (2) 11.4573 grams of chemically pure oxalic acid dissolved to 1 litre. (3) A solution made by dissolving 5 grams of pure tannin to 1 litre. (4) A 5 per cent. solution of pure potash-alum which should not consume any permanganate.  
L. DE K.

**Detection of Gelatin and Gelose in Jams.** By A. DESMOULIÈRE (*Ann. Chim. anal.*, 1902, 7, 201—204).—Gelatin is sought for, as usual, by adding excess of alcohol and testing the precipitate with tannin, picric acid, and quick-lime (soda-lime). Gelose is tested for as follows: 30 grams of the sample are heated with 10 c.c. of water and 150 c.c. of strong alcohol are added. After 12 hours, the liquid is decanted and the deposit is dissolved in 50 c.c. of water and boiled for a few minutes. Lime-water is added until the solution is strongly alkaline to litmus paper, the liquid is passed through a fine cloth which retains the calcium pectate, and the solution is now rendered nearly neutral by means of oxalic acid. After concentrating the liquid to 30 c.c., 2 c.c. of commercial formaldehyde are added and the whole is evaporated to dryness. The residue is then boiled with 50 c.c. of water and filtered through a hot-water funnel. (In the absence of gelatin, the addition of formaldehyde and subsequent evaporation may be dispensed with.) The filtrate is finally evaporated to about 7 c.c. and then allowed to cool. If gelose is present, the solution will be more or less gelatinised.  
L. DE K.

**Estimation of Diastases; Colorimetric Estimation of Oxydases.** By HENRI ALLIOT and M. EMM. POZZI-ESCOT (*Ann. Chim. anal.*, 1902, 7, 210—212).—The authors have found it impossible to estimate oxydases colorimetrically either by Laborde's guaiacol method, or Kastle and Schedd's phenolphthalein process (this vol., i, 514).  
L. DE K.

**Composition and Volumetric Estimation of Sodium Methylarsinate.** By ALPHONSE L. ADRIAN and J. AUGUSTE TRILLAT (*Compt. rend.*, 1902, 134, 1231—1232).—Sodium methylarsinate has the composition  $\text{Na}_2\text{MeAsO}_3 \cdot 6\text{H}_2\text{O}$ . In order to estimate this compound, it is precipitated with a slight excess of standard silver nitrate solution, filtered, and the excess of silver determined by means of standard thiocyanate solution. A correction must be made on account of the solubility of silver methylarsinate; 50 c.c. of the saturated solution consume 0.5 c.c. of decinormal thiocyanate solution.  
C. H. B.

## General and Physical Chemistry.

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**Refractive Indices of Solutions in Carbon Disulphide.** By CARL FORCH (*Ann. Physik.*, 1902, [iv], 8, 675—685).—The refractive indices of solutions of various concentrations of sulphur, naphthalene, ether, chloroform, paraffin oil, and castor oil in carbon disulphide have been determined. The value of the refractive indices of the chloroform solutions changes almost exactly proportionally with the dilution. The addition of naphthalene scarcely changes the refractive index of carbon disulphide. The results are given in the form of curves.

J. McC.

**Spectra arising from the Dissociation of Water Vapour and the Presence of Dark Lines in Gaseous Spectra.** By JOHN TROWBRIDGE (*Phil. Mag.*, 1902, [vi], 4, 156—161).—When a tube containing hydrogen and a little air and water is subjected to a powerful discharge, a spectrum is obtained which shows, besides hydrogen, sodium (from the glass), dissociated water vapour, and argon.

The spectrum of a spark under water has been photographed and is continuous, and this is the dissociation spectrum of water under pressure. Plücker or Geissler tubes subjected to a powerful discharge give a faint continuous spectrum on which there are bright and dark lines in the photograph. The dark lines are not due to absorption by cooler layers of gas, but are attributed to the silver salt not being able to record an effect for this particular state of vibration, and this phenomenon increases in intensity with the temperature.

From the study of a photograph of the solar spectrum, the author concludes that oxygen is present in the atmosphere of the sun and that dissociation of water vapour takes place there.

J. McC.

**Rotation Dispersion of Spontaneously Active Substances.** By CHR. WINTHER (*Zeit. physikal. Chem.*, 1902, 41, 161—211).—The rotation of dimethyl, diethyl, and dipropyl tartrates in the pure state has been determined for red, yellow, green, light blue, and dark blue light, and at several temperatures. The rotation dispersion is anomalous in each case, but the dispersion curves of the three esters, that is, the curves showing the variation of the specific rotation with the wavelength of the light employed, form a continuous series; the form of the dispersion curve changes gradually either with rise of temperature or increase of molecular weight, the change being apparently the same in either case; thus the dispersion curve for diethyl tartrate at 70° is practically coincident with that for dipropyl tartrate at 20°. The variation of the specific rotation of the esters with temperature is in accordance with the equation  $[\alpha] = a - b(t - 149)^2$ ; 149° is the calculated temperature at which all the esters have the maximum value of rotation. The specific rotation, wave-length, and temperature are connected by the equation

$$[\alpha] = (c - d\lambda)/(\lambda - e) \cdot [(f\lambda - g)/(\lambda - h) - (t - 149)^2],$$

in which  $c, d, e, f, g$ , and  $h$  are constants: according to the author, this dispersion formula gives values more in accordance with experiment than the Cauchy-Boltzmann formula.

The rotation of solutions of tartaric and malic acids has been determined, and the specific rotations of the acids themselves obtained by extrapolation; in the pure state and at low temperatures, these substances exhibit normal dispersion, but with rise of temperature or dilution the dispersion becomes anomalous, finally becoming normal again. The rotation of alcoholic solutions of tartaric acid has also been studied. For the range of concentrations chosen, the rotation values are much smaller than those in aqueous solution; the maxima on the dispersion curves lie between light and dark blue for the aqueous solutions, but between red and yellow for the alcoholic solutions; the rotation of the aqueous solutions diminishes rapidly, that of the alcoholic solutions increases slightly, with rising concentration.

The three esters referred to above, with tartaric and malic acids, are classed together in a group, the characteristics of which are anomalous dispersion and exceptionally large variation in the dispersion with temperature, concentration, and solvent. Sodium potassium tartrate, the rotation and dispersion of which were also studied, is an example of another class characterised by normal dispersion and slight variation in the dispersion with temperature and concentration.

If, in the case of the three ethereal tartrates, the rotation is measured, not from zero, but from the maximum rotation value above referred to, there is obtained what the author calls the "rational" specific rotation  $[A]$ : it is defined by the equations  $[A] = a - [\alpha] = b(t - 149)^2$ ; if the temperature as measured from the maximum point  $149^\circ$  be termed 'rational' temperature ( $T$ ), then obviously  $[A] = bT^2$ . From the 'rational' specific rotation, a 'rational' dispersion coefficient is deduced in the usual manner, and it is shown that for the three esters, tartaric and malic acids, this dispersion coefficient is independent of temperature. For the homologous esters, the 'rational' dispersion coefficient is apparently constant.

J. C. P.

**Comparison of the Radiations from Radioactive Substances.** By E. RUTHERFORD and Miss H. T. BROOKS (*Phil. Mag.*, 1902, [vi], 4, 1—23).—The more penetrating  $\beta$ -radiation from uranium is deflected by a magnet, the deflection being of about the same order as for radium rays. The  $\alpha$ -radiation is not affected by a magnetic field. The coefficient of absorption of  $\beta$ -rays by various metals has been determined, and it is found that the law of the absorption of cathode rays depending only on the density is not true for all substances. The most penetrating rays are the excited radiations due to thorium and radium, then follow in order the rays from thorium, radium, polonium, and uranium. In seeking for a connection between absorption and density, it has been found that when aluminium and air are compared, the absorption is proportional to the density. The result for the non-deviable rays is opposite to that for the deviable  $\beta$ -uranium rays.

The emanating power of radium is increased more than 10,000 times by heating to dull redness. From the rate of leakage from excited radio-



activity, it is deduced that the speed of formation of ions by this is greater than by the direct radiation. The penetrating power of radium-excited radiation is independent of the substance in which it is produced. The decay of excited radioactivity has been found to be a function of the time of exposure. J. McC.

**Electrolysis of Molten Salts.** By RICHARD LORENZ (*Zeit. anorg. Chem.*, 1902, 31, 385—390. Compare Abstr., 1901, ii, 142).—The author corrects some misconceptions in connection with his work on this subject. J. McC.

**Conductivity of Mixtures of Electrolytes.** By BR. SABAT (*Zeit. physikal. Chem.*, 1902, 41, 224—231).—The author has determined the conductivity of mixtures of hydrochloric, nitric, and sulphuric acids, and finds, within certain concentration limits, a fair agreement with the values calculated by Barmwater's formulæ (Abstr., 1899, ii, 396). J. C. P.

**Relation between Current Intensity and Manifestation of Electrolysis.** By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1902, 135, 5—8).—Previous experiments are extended to cases in which the *E.M.F.* only slightly exceeds that necessary for the electrolysis of water. The element employed contained solutions of sodium hydroxide with the addition of a small quantity of pyrogallol, and of sodium chloride with the addition of a little hydrogen peroxide, and the *E.M.F.* was about 0.86 volt. With two such elements in a voltameter containing sulphurous acid, no electrolysis was observed under 760 mm. pressure, but the action was evident under 8 mm. On the addition of pyrogallol, the action was evident under the ordinary pressure. This is in accord with previous observation, as it had been found that in the first case the quantity of hydrogen which could be liberated, about 0.00001 mgm. per minute, would only be visible under reduced pressure. Electrolysis was apparent with one element under reduced pressure and on the addition of pyrogallol, and the rate of evolution is calculated to be 0.000003 mgm. per minute, a quantity only just on the limits of possible observation. L. M. J.

**Electromotive Behaviour of Hypochlorous and Chloric Acids.** By ERICH MÜLLER (*Zeit. Elektrochem.*, 1902, 8, 425—439).—The author has shown (Abstr., 1900, ii, 643) that when a solution of a chloride is electrolysed with gradually increasing applied *E.M.F.* (the anode being a point of smooth platinum and the cathode a hydrogen electrode), there are two changes of direction (at 1.3 and 1.9 volts) in the curve representing the current passing. The second change (at 1.9 volts) is not observed when the anode is platinised, and it is not so well marked when the electrolyte is acid as when it is alkaline. Measurements are made of the *E.M.F.* of cells consisting of a hydrogen electrode and of a smooth platinum electrode immersed in an acid or alkaline solution of hypochlorous acid, or of chloric acid. The results show that chloric acid gives a very much lower *E.M.F.* than hypochlorous acid of similar concentration. A solution of hypo-

chlorous acid of about normal strength gives an *E.M.F.* about 0.1 volt higher than a saturated solution of chlorine. The author considers that these observations are best explained as follows. The change occurring at the anode is  $\text{Cl}' + \text{OH}' = \text{HClO} + 2\text{F}$ . In presence of a platinised electrode, the hypochlorous acid is very rapidly decomposed, so that its concentration can never rise much above the value corresponding with the equilibrium  $\text{Cl}_2 + \text{H}_2\text{O} \rightleftharpoons \text{HClO} + \text{HCl}$ . The decomposition point observed at 1.3 volts corresponds with the establishment of this equilibrium. With a smooth platinum anode, the catalytic decomposition of hypochlorous acid is very much slower, and its concentration may therefore become considerably greater than that given by the equilibrium. The higher decomposition point would thus be due to the formation of a concentrated solution of hypochlorous acid at the anode. That a solution of hypochlorous acid does not give so high an *E.M.F.* may be due to the fact that the concentration in contact with the electrode is diminished by catalytic decomposition and electrolytic reduction to a lower value than it would have if the hypochlorous acid were being formed at the electrode. T. E.

**Accuracy of the Improved Voltameter.** By THEODORE W. RICHARDS and GEORGE W. HEIMROD (*Zeit. physikal. Chem.*, 1902, 41, 302—330).—The authors previously (Abstr., 1900, ii, 256) recommended the insertion of a porous cell between the electrodes of the silver voltameter, and further experiments show that this form of apparatus gives very uniform and trustworthy results. The weight of silver deposited on the platinum crucible is the same as that deposited in a voltameter where the cathode is placed above the anode, and this weight is less than that obtained in any other form of voltameter. The higher value obtained in most voltameters is accounted for mainly by the formation at the anode of a complex silver ion such as  $\text{Ag}_3^+$ ; this ion would be readily decomposed on continued contact with the anode, giving the finely divided silver usually found there, but in so far as it is transferred to the cathode it would lead to an excessive increase in the cathode deposit. Nitrite is formed at the anode, but this has only a slight influence on the weight of the cathode deposit.

The correct value for the electrochemical equivalent of silver is estimated to be 0.0011175 mgm. per coulomb. The electrochemical equivalent of copper is 0.00032929 mgm. per coulomb; this leads to a value for the atomic weight of 63.601, agreeing closely with that found by purely chemical methods (63.604).

The term "coulometer" is proposed as a substitute for "voltameter."

J. C. P.

**Electrolysis of Silver Nitrate.** By ANATOLE LEDUC (*Compt. rend.*, 1902, 135, 23—25).—It is generally stated that silver nitrate becomes acid during electrolysis, but Rodger and Watson found that the acidity of a silver nitrate bath diminished. The apparent contradiction is due to a difference of condition; with platinum electrodes in a sufficiently concentrated solution, a brown solid containing a higher oxide of silver is formed with simultaneous formation of nitric acid, which, however, when a sufficient concentration is reached, reacts on the

compound with formation of oxygen. Similar results are obtained with soluble anodes and current of sufficient density, and the acidity of the bath therefore leads to a limiting value. The author finds that corrosion or solution of the cathode deposit does not take place, and the experiments also indicate that in a silver nitrate voltameter the polarisation *E.M.F.* is about 0.03 volt.

L. M. J.

**The Electrochemical Equivalent of Silver.** By ANATOLE LEDUC (*Compt. rend.*, 1902, 135, 237—240).—The author calls attention to the differences in the determinations of the electrochemical equivalent of silver which have been made, and discusses the causes of these. With a normal solution of silver nitrate at the ordinary temperature, if the anodic density is lower than 0.002 C.G.S. units, nitric acid is not formed at the anode in appreciable quantity. Under these conditions, the cathode deposit of silver is quite normal. If the anodic density is greater, the concentration lower, or the temperature higher, nitric acid is formed and disturbs the deposition of the silver at the cathode. When the current density is greater, the ill effect of the acid can be destroyed by adding silver oxide to the bath. If the proper conditions as to temperature, current density, acidity and basicity of the bath, and concentration be adhered to, it is possible to determine the electrochemical equivalent to 1/10000.

J. McC.

**Velocity of Ions in a Flame containing Salts.** By GEORGES MOREAU (*Compt. rend.*, 1902, 134, 1575—1577).—The conductivity of a flame containing a vaporised salt is of an electrolytic nature, and hence, from the conductivity, the velocity of the ions in the flame may be calculated. Two platinum plates were placed respectively in a pure flame and one containing the salt, the flames being in contact. The plate in the pure flame was charged positively, and from the current produced, the velocity of the negative ions was determined. It was found that in the case of various potassium and sodium salts the velocity of the negative ion at any concentration is independent of the radicle which should furnish it, indicating that one negative ion really exists for all these salts, and that its mobility is a function of the concentration. According to the view of Arrhenius, this ion is OH produced by hydrolysis of the vaporised salt, but the author postpones the discussion of this hypothesis.

L. M. J.

**Carbon Ions.** By JEAN BILLITZER (*Monatsh.*, 1902, 23, 502—511. Compare Coehn, *Abstr.*, 1901, ii, 539).—On electrolysis at 18° of an aqueous solution of silver acetylide or copper acetylide, or of a solution of acetylene in aqueous sodium hydroxide, the curve representing voltage and current intensity shows breaks at 0.75, 1.09, and 1.27 volts. The break at 1.27 is caused by depolarisation of the hydroxyl ions by acetylene liberated by hydrolysis, the discontinuity at 1.09 is due to the formation of oxygen ions, and that at 0.75 must represent the formation of carbon ions  $C_2$ . With silver acetylide solution at 28° and 38°, the breaks representing the carbon ions are at 0.82 and at 0.87 respectively; with sodium acetylide at 36° and 60°, the break is at 0.86 and at 1.02 respectively.

From the figures obtained, the heat of formation of acetylene is calculated by Helmholtz's equation to be  $-49.5$  Cal., which agrees fairly closely with the value  $-53.2$  Cal., estimated directly.

With a solution of silver acetylide, an anode potential of  $0.9$  volt, and a platinum electrode with a surface of  $10$  sq. cm., the current intensity cannot be increased beyond  $0.0001$  ampere. After some weeks, small, silver crystals are observed on the cathode, and a slight, smooth, dark deposit on the anode. The anode deposit does not contain silver, leaves no residue when heated in a bunsen flame, is dissolved by chromic acid, and is undoubtedly carbon. G. Y.

**Electrolytic Phenomena at the Surface of Separation of Two Solvents.** By WALTHER NERNST and E. H. RIESENFELD (*Ann. Physik.*, 1902, [iv], 8, 600—608).—When a current passes through a U-tube containing a solution at the bottom and another solvent on both sides, electrolytic phenomena take place on account of the migration of the dissolved substance. The deduction is made that the electrolyte diffuses into the two solvents according to the distribution ratio and the ratio of the square root of the diffusion coefficients. The quantity of electrolyte which remains at the surface of separation depends only on the current passed through and on the difference of the transport numbers of the electrolyte in the two solvents.

This has been experimentally proved with potassium tri-iodide in water and water saturated with phenol. It has also been proved by experiments with potassium dichromate, ferric thiocyanate, and o-nitrophenol. With the latter, there is an increase of concentration at the anode and a decrease at the cathode, the change being easily recognised by the colour. With potassium tri-iodide, the increase of concentration takes place at the cathode. The method can be used to determine the transport number in one solvent if that in the other is known. J. McC.

**Transport Number of some Salts in Phenol.** By E. H. RIESENFELD (*Ann. Physik.*, 1902, [iv], 8, 609—615).—In order to test the method suggested in the preceding abstract for determining the transport number, the change of concentration of an aqueous solution over a phenol solution in a U-tube was determined when a current was passed through. The transport number is then found from the loss of anion at the cathode and the quantity of silver separated in an interposed voltameter. The transport number in phenol is independent of the concentration of the solution, of the duration of the electrolysis, and of the form and size of the vessel. The transport number for potassium (in potassium chloride, bromide, or iodide) in phenol is  $0.81$ ; for lithium (in lithium chloride) it is  $0.77$ . J. McC.

**Concentration Elements with Immiscible Solvents.** By E. H. RIESENFELD (*Ann. Physik.*, 1902, [iv], 8, 616—624).—When two immiscible solvents containing a common dissolved electrolyte are in contact, three equilibria have to be established: (1) that between the undissociated parts in the two solutions, (2) and (3) those between like ions in the two solutions. An *E.M.F.* is thus set up at the surface of separation which, however, cannot yet be measured. Nernst's



theory on this equilibrium enables the author to calculate the *E.M.F.* of a cell which contains a solution of the electrolyte in an immiscible solvent interposed between the two solutions of different concentrations. The formula developed is  $E.M.F. = 2nRT/m \cdot \log(c_1/c_2)$ , where  $n$  is the transport number in the interposed solvent,  $m$  the valency of the ion, and  $c_1$  and  $c_2$  are the concentrations. Experiments have been carried out with potassium chloride, potassium bromide, potassium iodide, and lithium chloride, the interposed solvent being phenol. The current flows from the concentrated solution to the dilute solution through the element. The values of the *E.M.F.* may be used to calculate the transport number and in this way the numbers found are : for potassium chloride, bromide, and iodide, 0.645, 0.643, and 0.646 respectively ; for lithium chloride, 0.574. In all cases, these are lower than the transport numbers already found (see preceding abstract). J. McC.

**Magnetism of Alloys of Iron and Silicon.** By AD. JOUVE (*Compt. rend.*, 1902, 134, 1577—1579).—The attraction of an electromagnet on a constant mass of the alloy was determined, and a curve is given for attraction against composition. It is seen that two sudden changes occur at places corresponding with the compositions represented by  $\text{Fe}_2\text{Si}$  and  $\text{FeSi}$ , which compounds the author considers to be the only ones produced. The variation of the attraction further affords a method for the rapid determination of the percentage of silicon in the alloy. L. M. J.

**Thermal Properties of Carbon Dioxide and of Ethane.** By J. P. KUENEN and W. G. ROBSON (*Phil. Mag.*, 1902, [vi], 3, 622—630).—From examination of all the trustworthy data, the authors find that carbon dioxide obeys satisfactorily the law of corresponding states. The mean density of liquid and saturated vapour is, however, not a straight line but slightly convex towards the temperature axis. From the law of corresponding states, the vapour volumes below  $0^\circ$  are calculated and hence by means of the expression  $L = (V_v - V_e)T \cdot dp/dt$ , the latent heat of evaporation is obtained ; the value of the latter was found to decrease from 95.3 cal. at  $-65.7^\circ$  to 56.0 cal. at  $0^\circ$ . At the triple point  $-56.24^\circ$ , the value is 86.1 cal. ; the density of the solid is about 1.48, and the latent heat of sublimation is found to be about 129.9 cal., and hence the latent heat of fusion is 43.8 cal. At the boiling point, the latent heat of sublimation is about 121 cal. ; it hence increases with rise of temperature. In the case of ethane, the latent heat of evaporation was found to decrease from 111 cal. at  $-74.7^\circ$  to 45.7 cal. at  $22.9^\circ$ , the slope of the curve being considerably greater than in the case of carbon dioxide. L. M. J.

**Conductivity and Atomic Heat of the Metals.** By FRANZ STREINTZ (*Ann. Physik.*, 1902, [iv], 8, 847—853).—From the known electrical conductivities of metals at various temperatures, the author shows that in all cases the temperature coefficient is greater than  $1/273$ . In the group of metals with high atomic weight, the temperature coefficient increases with the atomic weight. This applies also to metals the atomic weight of which lies between 100 and 120 ; for

metals of lower atomic weight, it is only applicable to copper and zinc.

Metals of high atomic weight have a negative temperature coefficient of heat conductivity. The ratio of the two conductivities is only proportional to the absolute temperature for metals of medium atomic weight.

The temperature coefficient of the atomic heat is apparently connected with the temperature coefficient of the electrical conductivity, and the author draws the conclusion that for a metal of high atomic weight the smaller the displacement of the atoms compared with the distance between the atoms, the greater is the temperature coefficient of the electrical resistance. J. McC.

**Conductivity and Dielectric Constant of Solvents and Solutions and the Influence of Temperature to beyond the Critical Point on These.** By P. EVERSHEIM (*Ann. Physik.*, 1902, [iv], 8, 539—567).—The conductivity and dielectric constant of liquid sulphur dioxide has been determined at temperatures from  $14\cdot5^{\circ}$  to  $157\cdot5^{\circ}$ ; both decrease as the temperature rises and immediately before the critical point the fall is very sudden, but there is no discontinuity. From the dielectric constants found it is shown that the Clausius and Mosotti formula does not lead to a constant value but is dependent on the absolute temperature. The addition of potassium chloride, potassium bromide, or rubidium iodide to the sulphur dioxide conditions a great increase in the conductivity. The conductivity of these solutions decreases with rising temperature, and shows a sharp fall near the critical point.

The dielectric constant of ethyl ether was determined and again it was found that the Clausius and Mosotti expression is dependent on the temperature. The conductivity of a solution of hydrogen chloride in ethyl ether decreases as the temperature rises, and the resistance becomes very great just at the critical point; the resistance has a minimum value at about  $-20^{\circ}$ . The densities of ethyl ether and ethyl chloride at temperatures from  $15^{\circ}$  to  $195^{\circ}$  have also been determined. The dielectric constant of ethyl chloride and the conductivity of a solution of mercuric chloride in that solvent have been determined at various temperatures and the relationships are the same as those found for ethyl ether and its solution. J. McC.

**Molecular Attraction.** By J. E. MILLS (*J. Physical Chem.*, 1902, 6, 209—236).—The validity of the expression  $PV = RT$  for dissolved substances leads to the conclusion that the average translational energy of gaseous and liquid molecules at the same temperature must be equal. The internal latent heat is, therefore, solely spent in altering the distance of the molecules. Assuming that the attraction between the molecules varies inversely as the square of the distance, an expression is deduced for the energy necessary to produce an expansion of mass  $M$  from density  $d$  to density  $D$ ; this is  $M\mu c(\sqrt[3]{d} - \sqrt[3]{D})/\sqrt[3]{m}$ , where  $m$  is the weight of the molecule,  $\mu$  the attraction at unit distance, and  $c$  an unknown constant. Hence it follows that the ratio of the internal latent heat at two temperatures is equal to the ratio

of the values ( $\sqrt[3]{d} - \sqrt[3]{D}$ ) for these temperatures, assuming that  $\mu$  is constant, and this affords a test of the validity of the expression. In the twenty cases examined, the agreement is very satisfactory, but the ratios in many instances being near unity, the results are further tested by comparison of the difference between the two latent heats with that deduced by means of the expression. Only in the cases of water and ethyl alcohol is the difference greater than 5 calories, and in these compounds it is doubtful whether constancy of the number of molecules at different temperatures can be justly assumed. The values of the internal latent heat deduced from the author's expression are also compared and found to agree with those obtained by Crompton's formula,  $L_T = 2RT \log_e d/D$ . The author considers that these results afford evidence to prove that (1) molecular attraction varies inversely as the square of the distance, (2) the attraction constant is only slightly affected by temperature, (3) the attraction depends primarily on the chemical constitution of the molecule.

L. M. J.

**Thermodynamics and the Dissociation Theory for Binary Electrolytes.** By MAX PLANCK (*Zeit. physikal. Chem.*, 1902, 41, 212—223).—The conclusions which can be drawn from the laws of thermodynamics alone, as applied to the case of a binary electrolyte, are clearly distinguished from those which can be drawn with the addition of the dissociation hypothesis. In agreement with Jahn and Nernst, the author regards the dynamical methods of determining the degree of dissociation from the conductivity or from reaction velocities as inferior to the statical methods, that is, those depending on the determination of the osmotic pressure and allied quantities. The conductivity method of determining the degree of dissociation is based on the assumption that the mobility of the ions is independent of the concentration, and in support of this there is as yet no experimental evidence.

J. C. P.

**Outline of an Expanded Theory of Dilute Solutions.** By HANS JAHN (*Zeit. physikal. Chem.*, 1902, 41, 257—301).—As is well known, strong electrolytes do not obey Ostwald's law, and the question has arisen how far the ordinary methods of determining the degree of dissociation are valid in these cases. The abnormal behaviour of strong electrolytes may be due to some action between the ions and molecules of the solute. On this assumption, the author arrives thermodynamically at certain equations for the dissociation isotherm, the depression of the freezing point, the *E.M.F.* of concentration cells, &c. Thus, instead of the old form,  $n_1^2/(N - n_1) = K$ , for the dissociation isotherm, the author obtains the equation  $n_1^2/(N - n_1) \cdot e^l = k$ , where  $l = -aN/n + n_1(2a/n - b/n)$ ;  $a$  and  $b$  are functions of the pressure, the temperature, and the composition of solute and solvent,  $a$  expressing the action between the ions and the undissociated molecules,  $b$  the action between the ions themselves. An action of the ions on the undissociated molecules would be possible when the latter had a dielectric constant differing from that of the surrounding medium. On *a priori* grounds,  $b$  is assumed to be small, and the abnormal behaviour of strong electrolytes is thus attributed to the action of the free ions on the undis-

sociated molecules. This introduces a simplification in the author's equations, and their applicability and consistency are tested for potassium and sodium chlorides. In these cases, it is shown that  $K$  of the equation quoted above is satisfactorily constant, and has the same value whether the degree of dissociation is obtained from the freezing point or from a concentration cell. The freezing point data used are those of Abegg and Loomis, and the author himself has measured the *E.M.F.* of suitable concentration cells; from these experimental data, the degree of dissociation is calculated by the author's own equations.

The conductivity can be accepted as a measure of the dissociation only in very dilute solutions, since apparently the mobilities of the ions change with the concentration.

J. C. P.

#### Molecular Condition of Potassium Iodide [dissolved] in Phenol.

By E. H. RIESENFELD (*Zeit. physikal. Chem.*, 1902, 41, 346—352).—From partition and conductivity experiments, it appears that potassium iodide is strongly dissociated in phenol which is saturated with water; the mobility of the ions in this medium is about one-fifth of that in pure water.

The molecular weight of potassium iodide in anhydrous phenol (determined cryoscopically) is normal, and a study of the conductivity of the solutions shows that the dissociation is but slight. When water is added to a solution of potassium iodide in anhydrous phenol, the resistance diminishes almost in proportion to the amount of water added.

J. C. P.

Behaviour of Succinic and Phthalic Anhydrides towards Water. By E. VAN DE STADT (*Zeit. physikal. Chem.*, 1902, 41, 353—369).—The complete freezing point curves for mixtures of (1) succinic anhydride and water, (2) phthalic anhydride and water, have been determined. In each case, there is one well-marked rounded summit, corresponding with the formation of the acid. The eutectic points on either side are only very slightly below the freezing points of anhydride and water, owing to the slight solubility of either acid in water at 0°, and in the anhydride at its melting point. The author's results are therefore in conflict with Bancroft's view (*Abstr.*, 1899, ii, 411) that phthalic acid and anhydride form a continuous series of mixed crystals. The fact that the summits of the freezing point curves are rounded shows that the acids in the liquid condition are partly dissociated; accurate determinations, therefore, of the freezing points can be made only in closed vessels. At low temperatures, the anhydrides dissolve as such in water (compare van de Stadt, *Abstr.*, 1900, i, 200), and are hydrated very slowly. The rapidity of hydration increases with the temperature, and above 100° the anhydride in contact with water is instantly converted into the corresponding acid. Owing to the rapid establishment of equilibrium between water, anhydride, and acid in the liquid phase, the rate of heating has no effect on the value obtained for the melting point of the acids or their anhydride mixtures, provided, of course, water vapour does not escape. This also is in conflict with Bancroft's observations.

J. C. P.



**Study of Diffusion.** By J. THOVERT (*Ann. Chim. Phys.*, 1902, [vii], 26, 366—432).—This contains a mathematical treatment of the phenomenon of the diffusion of liquids and solutions, and is not suitable for abstraction. G. T. M.

**The Equation of Fluids.** By PHILIPPE A. GUYE and L. FRIDERICH (*Arch. Sci. Phys. Nat.*, 1902, 13, 559—568).—The values of  $a$  and  $b$  in van der Waals' equation have been previously published for a large number of compounds at the critical state (Abstr., 1900, ii, 709). For a liquid sufficiently removed from the critical condition, the value of  $p$  in the equation is negligible compared with  $a/v^2$ , and the equation reduces to  $a/v^2 = RT/(v - b)$ , and by elimination of  $b$  from two such equations  $a = R(T_2 v_2^2 - T_1 v_1^2)/(v_2 - v_1)$ . The value of  $a$  can also be obtained from the equation  $a/v^2 = RT/(v - b)$ , or from the original van der Waals' equation by differentiation. For the vapour phase, the values of  $a$  and  $b$  are obtained by the combination of van der Waals' equation with that of Ramsay and Young,  $p = \beta T - a$  ( $v = \text{constant}$ ). The values for  $a$  and  $b$  in the liquid and vapour phases were thus determined in the case of isopentane and found to differ considerably. Thus at  $30^\circ$  for liquid isopentane,  $a \times 10^{-6} = 11.54$ ,  $b = 88.2$ ; whilst for the vapour,  $a \times 10^{-6} = 40.63$ ,  $b = 415$ , the values at the critical state being 18.33 and 143.6. L. M. J.

**Vapour Pressures in the System: Water-Acetone-Phenol.** III. By FRANZ A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 1902, 41, 331—345. Compare this vol., ii, 243, 380).—The composition of the systems, which at various temperatures have a vapour pressure of (1) 380 mm., (2) 760 mm. has been determined, and the results are represented graphically on triangles. The conditions are then deduced under which a three phase system consisting of two liquids and a vapour, the pressure of the latter being 380 mm., can exist.

When water is added to a phenol-acetone mixture, it depends on the composition of the latter whether its boiling point under 760 mm. will be raised or lowered (compare Schreinemakers, Abstr., 1901, ii, 445, 641). The limiting binary mixture in this case contains 34.8 per cent. of phenol and 65.2 per cent. of acetone. The boiling point of a mixture containing more phenol will be at first lowered by the addition of water, that of a mixture with less phenol will be continuously raised. Addition of phenol to aqueous acetone first produces depression of the boiling point when the mixture contains less than about 5 per cent. of acetone: the boiling point of mixtures with more than 5 per cent. of acetone is continuously raised by the addition of phenol. The addition of acetone to water-phenol mixtures (whatever their composition) produces a depression of the boiling point. J. C. P.

**Observations on Mixtures with Maximum or Minimum Vapour Pressure.** By J. P. KUENEN and W. G. ROBSON (*Phil. Mag.*, 1902, [vi], 4, 116—132. Compare Abstr., 1901, ii, 146).—The simultaneous occurrence of a maximum vapour pressure with a minimum critical temperature or of a minimum vapour pressure with a maximum critical temperature is a consequence of van der Waals' theory, pro-

vided that there is no association of the liquids. A mixture of propyl alcohol and water containing 25 per cent. of water has a maximum vapour pressure which it retains up to the critical temperature, and the critical temperature shows no minimum. This abnormality is traced to the association of the water molecules. A mixture containing acetone and chloroform has a minimum vapour pressure which moves as the temperature rises and disappears at the critical temperature, which itself exhibits no maximum. The vapour pressures of mixtures of carbon dioxide and ethane were determined at temperatures below  $0^{\circ}$ ; this mixture has a maximum vapour pressure and a minimum critical temperature, but no separation into two liquid phases was brought about by lowering the temperature. The authors also discuss the condensation of various mixtures of carbon dioxide and ethane at different temperatures, solidification, and the heats of evaporation.

J. McC.

**Studies in Vapour Composition. II.** By H. R. CARVETH (*J. physical Chem.*, 1902, 6, 237—256).—A paper in which the author discusses methods for the determination of the boiling point; this and other physical constants are frequently taken in systems for which all the equilibrium factors are not specified or considered. It is shown that superheating may be avoided and a constant boiling point obtained by employing the vapour as the source of heat even when the vapour itself is superheated, as changes in its temperature have practically no effect on the boiling point. By passing vapour A into liquid B, the boiling point changes in a continuous manner from that of A to that of B, and boiling point curves may be readily investigated in this way, which is especially convenient for the determination of maxima or minima. Dephlegmation and continuous distillation are also briefly discussed.

L. M. J.

**Solubility of Carbon Monoxide in Binary Organic Mixtures.** By FREDERICK WILLIAM SKIRROW (*Zeit. physikal. Chem.*, 1902, 41, 139—160).—The method employed was, with slight modifications, that of Just (*Abstr.*, 1901, ii, 439). Except where analysis was possible, the composition of a mixture of two liquids was obtained from the index of refraction by interpolation, the empirical curve giving the relation of these two quantities being already known.

When one of the components of the mixture is very volatile, and the other slightly volatile, as in mixtures of benzene, toluene, acetone, or acetic acid with aniline or nitrobenzene, the solubility is mainly additive, the solubility curves being slightly convex towards the composition axis. The same holds for solutions of naphthalene, phenanthrene, and  $\alpha$ - and  $\beta$ -naphthol in benzene, toluene, or acetone.

In the case of two easily volatile liquids, it was thought that there might be some connection between the vapour pressure curve and the carbon monoxide solubility curve. The vapour pressure curve for mixtures of acetone and chloroform shows a minimum, but the solubility curve exhibits no special feature. Neither in cases where there is a maximum in the vapour pressure curve (acetone-carbon disulphide, benzene-ethyl alcohol, chloroform-methyl alcohol) was any peculiarity

discoverable. On the other hand, a connection was found between the surface tension and carbon monoxide solubility curves of certain mixtures. Where the surface tension curve exhibits a minimum, as in the cases acetic acid and benzene, acetic acid and toluene, acetic acid and chloroform, carbon disulphide and ethylene dichloride (compare Whatmough, this vol., ii, 125), the carbon monoxide solubility curve shows a maximum.

J. C. P.

**Cause of the Influence of Positive and Negative Catalysers on the Velocity of Hydration in some Inorganic Reactions.** By PAUL ROHLAND (*Zeit. anorg. Chem.*, 1902, 31, 437—444. Compare Abstr., 1899, ii, 596; 1901, ii, 18).—The author has collected the results previously obtained on the influence of certain salts on the velocity of hydration of calcium sulphate, calcium oxide, and Portland cement. The velocity of hydration depends on the solution pressure of the substance in the solution under examination. If the calcium sulphate is more soluble in a solution of a particular salt than in water, the velocity of hydration is increased, but if it is less soluble the hydration is retarded. The cause of this may be the formation of complex ions.

J. McC.

**Formation of Colloidal "Bubbles" from Heptylamine Soaps and Water. I.** By FRIEDRICH KRAFFT (*Zeit. physiol. Chem.*, 1902, 35, 364—375. Compare Abstr., 1896, ii, 468, and Donnan, Abstr., 1900, ii, 201).—A *résumé* of early work on formation of emulsions and froth. The colloidal nature of a sodium soap increases with the molecular weight of the acid molecule. Similarly, the colloidal nature of the hydrochloride of organic amines increases with the molecular weight of the base. It is now shown that the formation of membranes is exhibited to an extraordinary degree by soaps formed from a base and an acid both of high molecular weight: for example, heptylamine oleate.

J. J. S.

**Formation of Colloidal "Bubbles" from Heptylamine Soaps and Water. II.** By FRIEDRICH KRAFFT and R. FUNCKE (*Zeit. physiol. Chem.*, 1902, 35, 376—385. Compare preceding abstract).—Heptylamine soaps are readily prepared by bringing their constituents together in a liquid state and allowing the mixture to solidify. They form crystalline plates and melt at temperatures slightly lower than those of the acids from which they are derived, thus *heptylamine oleate* melts at 13·8° and the acid at 14°; the *elaidate* at 45° and the acid at 45°; the *erucate* at 21·5° and the acid at 33°; the *brassicinate* at 44·5° and the acid at 60°.

These soaps are not so readily dissociated by water as the sodium soaps of the same acids. The formation of colloidal bubbles may readily be observed at the ordinary temperature when heptylamine oleate or erucate is brought into contact with water. Although molten heptylamine soaps have no action on polarised light, the colloidal emulsions are strongly doubly refractive. The heptylamine soaps of higher melting point do not exhibit swelling (*Quellung*) with cold water, but with tepid water show the same phenomena as the

soaps of lower melting point. As the temperature falls, crystals separate, and often both crystals and "bubbles" can be observed in the same liquid (compare Abstr., 1901, i, 63). The colloidal bubbles are readily coloured by methylene-blue, &c.

J. J. S.

**General Numerical Connection between the Atomic Weights.** By J. H. VINCENT (*Phil. Mag.*, 1902, [vi], 4, 103—115).—The author gives an historical account of the numerical connections which have been deduced by Mills, Stoney, and Carnelley. The atomic weight is calculated from the formula  $W = (n + 2)^{1.21}$ , where  $n$  is the order on a list of atomic weights arranged in ascending magnitude. The mean percentage difference between the values found in this way and the determined atomic weights ( $H = 1$ ) is 1.6. The formula gives results for known elements for values of  $n$  from 3 to 60. For the other elements, the formula is used in the form  $W = N^{1.21}$ , and from the values obtained it is clear that there are blanks in the list to be filled up by elements yet to be discovered. The applicability of this formula indicates that the list of atomic weights starts abruptly at hydrogen but has no end.

J. McC.

**The Ratios of the Atomic Weights.** By ARTHUR MARSHALL (*Chem. Zeit.*, 1902, 26, 663—664).—The author discusses the probability of the atomic weights being whole numbers. It is pointed out that when the atomic weights of certain series of elements are multiplied by an arbitrary factor, a ratio in whole numbers is obtained; thus, when the atomic weights of chlorine, bromine, silver, and iodine are multiplied by 2.53868, the ratio obtained is 90 : 203 : 274 : 322; for the alkali metals (including ammonium), the factor is 1.004, whilst for the metals vanadium, chromium, manganese, iron, nickel, cobalt, copper, and zinc, the factor is 1.0551. The theoretical significance of these regularities is not discussed.

J. McC.

**Apparatus for Studying Contact Reactions. Use of the Platinum Spiral.** By J. AUGUSTE TRILLAT (*Bull. Soc. Chim.*, 1902, [iii], 27, 797—803).—The author gives a description and illustration of an apparatus for studying oxidation phenomena induced by a red hot platinum spiral. The platinum spiral is enclosed in a narrow glass tube through which the vapour of the substance to be oxidised is passed along with air, and from which an outlet tube passes into a flask in which the products of oxidation can be collected. The spiral can be raised to incandescence by means of an electric current; in some cases, it is only necessary to use the current for the initial heating, the heat evolved on oxidation being then sufficient to maintain the spiral at a red heat. The tube containing the platinum spiral is surrounded by a water condenser to prevent the re-decomposition of the products of oxidation.

A. F.



## Inorganic Chemistry.

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Intensifying ("Activirende") Action of Reducing Agents, Colloidal Noble Metals, Alkaloids, and other Basic Substances on Oxidising Agents. By EDUARD SCHÄER (*Annalen*, 1902, 323, 32—82).—The intensifying action of sulphurous acid, hydrogen peroxide, colloidal gold and platinum, alkaloids and insoluble carbonates on certain oxidising agents has been studied, using the oxidisable substances potassium iodide, guaiacum, indigo-carmin pyrogallol, guaiacol, *p*-phenylenediamine, and aloin as indicators.

A description of the experiments made on cupric salts has already been published (this vol., ii, 140).

Hydrogen peroxide, like sulphurous acid (*Abstr.*, 1901, ii, 603), intensifies the oxidising action of ferric salts on indigo, and, in addition, promotes the oxidation of guaiacum, potassium iodide, *p*-phenylenediamine, and guaiacol. Colloidal platinum, although not inducing any action on indigo, renders the oxidising agent more active towards the other oxidisable substances.

Sulphurous acid does not intensify the action of mercuric chloride, and hydrogen peroxide does so only in the case of aloin. Colloidal platinum induces the oxidation of guaiacum and pyrogallol by this reagent, and both this metal and colloidal gold promote the development of the guaiacol coloration. Pyrogallol is oxidised both by mercuric chloride and ferric salts in the presence of insoluble carbonates and alkaloids. Silver nitrate oxidises indigo and aloin in the presence of hydrogen peroxide, whilst the guaiacum and guaiacol colorations are developed in the presence of the colloidal noble metals.

Hydrogen peroxide intensifies the action of chromic acid on all the oxidisable substances under examination (compare Bach, this vol., ii, 251). Sulphurous acid promotes the oxidation of indigo, guaiacum, and aloin, whilst colloidal gold and platinum render the oxidising agent more active towards pyrogallol, *p*-phenylenediamine, and potassium iodide.

Hydrogen peroxide intensifies the action of hypochlorous acid on *p*-phenylenediamine; the colloidal metals promote the oxidation of guaiacum and aloin by this acid.

Chloric acid and the chlorates are rendered more generally active by sulphurous acid, but are not affected by hydrogen peroxide or the colloidal metals. Sulphurous acid has a less marked effect on bromic acid and the bromates; pyrogallol and *p*-phenylenediamine are attacked by these reagents in the presence of the colloidal metals, which also induce a slight oxidation of aloin.

Iodates oxidise indigo, pyrogallol, *p*-phenylenediamine, and guaiacol under the influence of sulphurous acid, hydrogen peroxide promotes the oxidation of pyrogallol and *p*-phenylenediamine; this effect is likewise produced by colloidal platinum, which also intensifies the action of the oxidising agent on guaiacol and aloin.

Nitric acid and the nitrates readily oxidise indigo and guaiacum

under the influence of sulphurous acid; hydrogen peroxide promotes the decomposition of indigo and potassium iodide, whilst the action on pyrogallol, *p*-phenylenediamine, guaiacol, and the iodide is intensified by the presence of colloidal platinum. Permanganates act more energetically on potassium iodide and *p*-phenylenediamine in the presence of hydrogen peroxide; sulphurous acid induces the oxidation of indigo, whilst guaiacum and *p*-phenylenediamine are oxidised under the influence of colloidal platinum, aloin being also affected by colloidal gold.

Benzoic peroxide is rendered more active towards indigo, guaiacum, and guaiacol by the presence of sulphurous acid; hydrogen peroxide promotes the oxidation of indigo, especially in warm solutions, it also produces a similar effect in the case of *p*-phenylenediamine. Colloidal platinum also influences the oxidation of indigo in warm solutions, and causes the development of a faint coloration with aloin.

Quinone is rendered more active by hydrogen peroxide and colloidal platinum, the first agent promotes the oxidation of indigo, potassium iodide, and guaiacol, whilst the second intensifies the action on guaiacum, pyrogallol, and aloin. The last of these substances and leucaniline are also oxidised by quinone in the presence of sulphurous acid or colloidal gold.

G. T. M.

**Crystallised Hydrogen Peroxide.** By WILHELM STAEDEL (*Zeit. angew. Chem.*, 1902, 15, 642—643).—When a concentrated solution of hydrogen peroxide is cooled, it solidifies and the crystals melt at  $-2^{\circ}$ . A 90—95 per cent. solution remains liquid at  $-20^{\circ}$ , but solidifies in a freezing mixture of ether and carbon dioxide. The eutectic point lies between  $-20^{\circ}$  and  $-23^{\circ}$ . The crystals, which are anhydrous, are colourless and prismatic. The best method of obtaining anhydrous hydrogen peroxide is by this freezing out process. When a trace of platinum sponge or manganese dioxide is thrown on to the anhydrous preparation, an explosive decomposition takes place; a mixture of powdered carbon or magnesium with a trace of manganese dioxide inflames when dropped on to it.

When a 90—95 per cent. solution of hydrogen peroxide is added to a concentrated solution of cadmium chloride, silky crystals separate which contain 23 per cent. of hydrogen peroxide.

J. McC.

**Preparation of Sulphuryl Chloride.** ALFRED WOHL & OTTO RUFF (D.R.-P. 129862).—The transformation of chlorosulphonic acid into sulphuric acid and sulphuryl chloride in molecular proportion is readily effected by boiling the compound with mercury or mercuric sulphate. If the apparatus is fitted with a reflux condenser at  $70^{\circ}$ , the sulphuryl chloride distils over in quantitative yield. The process is continuous and other metallic salts, such as those of tin and antimony, may be employed as catalysts; sulphur dichloride and iodine monochloride also produce the same effect.

G. T. M.

**The Lead Chamber Process in the Light of Physico-chemical Theories.** By E. HAAGN (*Zeit. angew. Chem.*, 1902, 15, 583—585).—The author believes that the lead chamber process can best be explained by physico-chemical theories on the assumption that

nitrosylsulphuric acid is formed as an intermediary product. Since this substance has a very low vapour tension, it is removed from the reaction mixture and thus the reaction is accelerated. J. McC.

**Theory of the Lead Chamber Process.** By GEORG LUNGE (*Zeit. angew. Chem.*, 1902, 15, 581—583. Compare this vol., ii, 315).—A reply to Th. Meyer (*Zeit. angew. Chem.*, 1901, 14, 1245 ; 1902, 15, 278) and Riedel (this vol., ii, 450). J. McC.

**Selenium. II.** By JULIUS MEYER (*Zeit. anorg. Chem.*, 1902, 31, 391—400).—A full account of the determination of the atomic weight of selenium (see this vol., ii, 392). Selenium can be completely reduced and separated in the elementary condition from an acid solution of a selenite by hydrazine. J. McC.

**Direct Hydrogenation of Nitrogen Oxides by Contact Action.** By PAUL SABATIER and JEAN B. SENDERENS (*Compt. rend.*, 1902, 135, 278—281).—When a mixture of nitrous oxide and hydrogen is passed over reduced nickel, a reaction takes place at the ordinary temperature with a large development of heat, and in presence of excess of hydrogen the oxide is completely reduced without any formation of ammonia. If the oxide is in excess, the front part of the metal becomes incandescent, higher nitrogen oxides appear in the cooler part of the tube, and a little ammonia is formed. Reduced copper behaves in the same way as nickel, but reduction does not take place below 180°. Mixtures of nitric oxide with excess of hydrogen are not reduced by nickel below 180°, but above this temperature water, ammonia, and nitrogen are formed. With excess of nitric oxide, the metal becomes incandescent. Copper behaves in the same way as nickel. With nitrogen peroxide and hydrogen, the phenomena are similar, but if the proportion of the peroxide is increased, ammonium nitrite and nitrate are formed as well as ammonia, and when the proportion exceeds a certain limit the metal becomes incandescent and an explosion usually occurs. Mixtures of nitric acid vapour and hydrogen are reduced in a similar manner.

C. H. B.

**Reactions in the Formation of Calcium Carbide.** By G. GIN (*Zeit. Elektrochem.*, 1902, 8, 397).—Free oxygen is found in the gases formed in the hottest portions of a calcium carbide furnace, whilst calcium vapour is found in cooler portions of the furnace. The author suggests that these substances may be formed by the reactions  $2\text{CaO} + 4\text{C} = 2\text{CaC}_2 + \text{O}_2$  and  $\text{CaC}_2 + 2\text{CaO} = 3\text{Ca} + 2\text{CO}$ , the temperature in the hottest zones of the furnace being higher than the dissociation temperature of carbon monoxide. T. E.

**Separation of Beryllium.** By GRÉGOIRE N. WYROUBOFF (*Bull. Soc. Chim.*, 1902, [iii], 27, 733—734).—For the purpose of separating beryllium from aluminium and iron, which generally accompany it in minerals, the author takes advantage of the fact that beryllium oxalate is very sparingly soluble, whereas the oxalates of aluminium and of iron are comparatively soluble in water. A. F.

**Properties and Constitution of Zinc Peroxides.** By ROBERT DE FORCRAND (*Compt. rend.*, 1902, 135, 103—106).—The zinc peroxides  $\text{Zn}_3\text{O}_5, 2\text{H}_2\text{O}$ ,  $\text{Zn}_3\text{O}_5, 3\text{H}_2\text{O}$ ,  $\text{Zn}_4\text{O}_7, 4\text{H}_2\text{O}$ , and  $2\text{ZnO}_2, 5\text{H}_2\text{O}$  (this vol., ii, 322) are stable in moist or dry air with the exception of the last, which at the ordinary temperature gradually changes into  $\text{Zn}_3\text{O}_5, 2\text{H}_2\text{O}$ . At  $100^\circ$ , the compound  $\text{Zn}_4\text{O}_7, 4\text{H}_2\text{O}$  is gradually converted into  $\text{Zn}_3\text{O}_5, 3\text{H}_2\text{O}$ , but both the hydrates of the oxide  $\text{Zn}_3\text{O}_5$  are stable at this temperature. The compound  $\text{Zn}_3\text{O}_5, 3\text{H}_2\text{O}$  at  $190^\circ$  and the compound  $\text{Zn}_3\text{O}_5, 2\text{H}_2\text{O}$  at  $210^\circ$  suddenly lose water and oxygen and are converted into the monoxide. All of them dissolve in dilute sulphuric acid without liberation of oxygen, yielding a solution which behaves like a mixture of zinc sulphate and hydrogen peroxide. The thermal disturbances at  $15^\circ$  are :

$\text{Zn}_3\text{O}_5, 2\text{H}_2\text{O}$ sol.	+ $3\text{H}_2\text{SO}_4$ diss.	develops	+ $16.04 \times 3$ Cal.
$\text{Zn}_3\text{O}_5, 3\text{H}_2\text{O}$	„ + $3\text{H}_2\text{SO}_4$	„ „	+ $15.49 \times 3$ „
$\text{Zn}_4\text{O}_7, 4\text{H}_2\text{O}$	„ + $4\text{H}_2\text{SO}_4$	„ „	+ $14.86 \times 4$ „
$\text{ZnO}_2, 2\text{H}_2\text{O}$	„ + $\text{H}_2\text{SO}_4$	„ „	+ $14.86$

If the compounds are regarded as true peroxides, all their heats of formation are largely endothermic, which scarcely agrees with their marked stability, but if they are compounds of zinc oxide with hydrogen peroxide, their heats of formation in the solid state from zinc oxide and liquid hydrogen peroxide are  $\text{Zn}_3\text{O}_5, 2\text{H}_2\text{O}_2$  sol. +  $12.29 \times 2$  or +  $8.19 \times 3$ ;  $\text{Zn}_3\text{O}_5, 2\text{H}_2\text{O}_2, \text{H}_2\text{O}$  +  $12.24 \times 2$  or +  $8.16 \times 3$ ;  $\text{Zn}_4\text{O}_7, 3\text{H}_2\text{O}_2, \text{H}_2\text{O}$  +  $11.96 \times 3$  or +  $8.97 \times 4$ , and  $\text{Zn}(\text{OH})_2, \text{H}_2\text{O}_2$  +  $4.87$ . It is noteworthy that all the compounds contain at least as many mols. of water as there are atoms of active oxygen. C. H. B.

**Precipitation of the Chlorides and Bromides of Cadmium, Mercury, and Tin by Sulphuric Acid.** By GEORGES VIARD (*Compt. rend.*, 1902, 135, 242—244).—Cadmium chloride can be almost completely precipitated by adding an excess of sulphuric acid to the aqueous solution. The chloride is slightly attacked by the acid in the cold. Depending on the amount of sulphuric acid used, the cadmium chloride separates as dihydrate or monohydrate.

Cadmium bromide is precipitated in the anhydrous form by an excess of sulphuric acid; it is not attacked in the cold by the acid.

Mercuric chloride and bromide and stannous chloride and bromide are precipitated by an excess of sulphuric acid. J. McC.

**Toning Solutions containing Lead Thionates.** By AUGUSTE LUMIÈRE and LOUIS LUMIÈRE and ALPHONSE SEYEWETZ (*Bull. Soc. Chim.*, 1902, [iii], 27, 792—797. Compare this vol., ii, 319).—The authors find that a toning-fixing solution of lead pentathionate and sodium thiosulphate yields results comparable with those obtained with a gold solution. On adding a quantity of gold equal to that contained in the ordinary toning-fixing solution, the tones obtained with a chlorocitrate paper are blacker and fresher than with the ordinary solution. Sulphur forms part of the toned image.

The authors have also tried other salts of lead, especially the various thionates, but the best results are given by the pentathionate. The solutions are, however, unstable and in course of time give a deposit



which appears to consist of sulphur, lead thiosulphate, and lead dithionate. A. F.

**Thallic Alum.** By AUGUSTO PICCINI and V. FORTINI (*Zeit. anorg. Chem.*, 1902, 31, 451—453. Compare Locke, this vol., ii, 497).—From thallic sulphate, the following double salts have been prepared:  $\text{Ti}_2(\text{SO}_4)_3 \cdot \text{R}_2\text{SO}_4 \cdot 8\text{H}_2\text{O}$  where  $\text{R} = \text{NH}_4$ , K, and Rb. The rubidium salt very easily loses water. Since indium ammonium alum passes at  $36^\circ$  into a double salt with 8 mols. of water, it seems probable that at some lower temperature the above thallic salts in contact with water would be transformed into the alums. Mixed crystals of ammonium alum with some of the aluminium replaced by thallium have been obtained. On sowing a supersaturated solution of ammonium alum with ammonium thallic sulphate, crystals of  $\text{Al}_2(\text{SO}_4)_3 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 8\text{H}_2\text{O}$  separate. Hence the octahydrated form of the double sulphates appears to be common to the salts derived from the three elements of the aluminium family, the stability of the compounds increasing with the atomic weight of the metal.

J. McC.

**Cuprous Compounds. II.** By GUIDO BODLÄNDER and O. STORBECK (*Zeit. anorg. Chem.*, 1902, 31, 458—476. Compare this vol., ii, 502).—In attempting to determine the solubility of cuprous bromide it has been found that in water it partially decomposes into cupric bromide and copper. From the equilibrium relationships between cuprous ions, cupric ions, and metallic copper, it has been proved that the cuprous ion is monatomic. Cuprous bromide is easily soluble in a solution of potassium bromide; in a dilute solution of a bromide, the complex ion  $\text{CuBr}_2'$  is present, whilst in more concentrated solution the complex ion is  $\text{CuBr}_3''$ . The discharge potential of cuprous ions is  $-0.454$  volt.

The equilibrium relationships between cuprous iodide, cupric iodide, and iodine show that reaction occurs according to the equation:  $2\text{Cu}^+ + 2\text{I}^- = 2\text{Cu} + \text{I}_2$ .

The solubility products of the cuprous haloids are:  $\text{CuCl}$ ,  $1.2 \times 10^{-6}$ ;  $\text{CuBr}$ ,  $4.15 \times 10^{-8}$ ; and  $\text{CuI}$ ,  $5.06 \times 10^{-12}$ . This is in agreement with Bodländer's rule (*Abstr.*, 1898, ii, 554) that the solubility decreases with diminishing discharge potential of the ions. In confirmation of Abegg and Bodländer's rule (*Abstr.*, 1899, ii, 542), it is found that the tendency towards the formation of complex ions increases as the decomposition tension or electro-affinity diminishes. Of the complex ions of the type  $\text{CuX}_2'$ , that containing iodine is the most stable and that with chlorine the least.

J. McC.

**Anhydrous Ammonio-cupric Chlorides: Cuprammonio-radicals.** By ALBERT BOUZAT (*Compt. rend.*, 1902, 135, 292—295).—The compound  $\text{CuCl}_2 \cdot 6\text{NH}_3$  is obtained by the action of liquefied ammonia on cupric chloride previously saturated with ammonia gas. It is a pale blue solid insoluble in liquefied ammonia, but soluble in water. It gradually dissociates, yielding the compound  $\text{CuCl}_2 \cdot 4\text{NH}_3$ , which has not previously been isolated, and its dissociation pressure is equal to atmospheric

pressure at about  $90^{\circ}$ . The compound  $\text{CuCl}_2 \cdot 4\text{NH}_3$  also readily dissociates, yielding the compound  $\text{CuCl}_2 \cdot 2\text{NH}_3$ , the dissociation pressure being equal to that of the atmosphere at about  $140^{\circ}$ . The heats of formation were determined by dissolving the compounds in (a) excess of ammonia solution, (b) excess of acid.

$\text{CuCl}_2$  sol. +  $2\text{NH}_3$  gas =  $\text{CuCl}_2 \cdot 2\text{NH}_3$  sol. develops + 45.5 Cal.

$\text{CuCl}_2$  „ +  $4\text{NH}_3$  „ =  $\text{CuCl}_2 \cdot 4\text{NH}_3$  „ „ + 72.06 „

$\text{CuCl}_2$  „ +  $6\text{NH}_3$  „ =  $\text{CuCl}_2 \cdot 6\text{NH}_3$  „ „ + 94.3 „

The heats of formation diminish and the dissociation pressure increases with an increase in the proportion of ammonia, and the value of the ratio  $Q/T$ , where  $T$  is the absolute temperature of dissociation at atmospheric pressure and  $Q$  is the heat of combination per mol. of ammonia, agrees with that found by Matignon in the case of other ammonio-chlorides.

$\text{Cu}$  sol. +  $2\text{NH}_3$  gas +  $2\text{HCl}$  gas =  $\text{Cu}(\text{NH}_3)_2\text{Cl}_2$  sol. +  $\text{H}_2$  gas develops + 52.9 Cal.

$\text{Cu}$  sol. +  $4\text{NH}_3$  gas +  $2\text{HCl}$  gas =  $\text{Cu}(\text{NH}_3)_4\text{Cl}_2$  sol. +  $\text{H}_2$  gas develops + 79.5 Cal.

$\text{Cu}$  sol. +  $6\text{NH}_3$  gas +  $2\text{HCl}$  gas =  $\text{Cu}(\text{NH}_3)_6\text{Cl}_2$  sol. +  $\text{H}_2$  gas develops + 101.8 Cal.

C. H. B.

[Density of Cuprous Iodide.] A Correction. By WALTHER SPRING (*Rec. trav. chim.*, 1902, 21, 294. Compare Abstr., 1901, ii, 451).—The molecular volume of cuprous iodide is not 34.73 but 32.72. The mol. volume, 33.61, is rather greater than that derived from the sum of the elements, namely, 32.72, but much smaller than 43.08 which is given by the density obtained by Schiff. The formation of cuprous iodide, therefore, probably takes place with expansion, but not to the extent of justifying any definite conclusion with regard to the decomposition of the substance by compression.

A. F.

Pasty Condition assumed by Aluminium in the Neighbourhood of its Melting Point, and the Application of this Property to the Division of the Metal. By ALBERT GRANGER (*Bull. Soc. Chim.*, 1902, [iii], 27, 789—790).—When aluminium is heated to a temperature of about  $600^{\circ}$ , its tenacity and hardness become greatly modified, the metal assumes a grained structure, and can be easily broken. On heating to a still higher temperature, the metal can be cut with a knife or even crushed in a mortar.

A. F.

Dialysis Experiments with Metallic Hydroxides and Sulphides. By W. HERZ (*Zeit. anorg. Chem.*, 1902, 31, 454—457).—When an alkaline solution of aluminium, lead, or stannous hydroxide is placed in a dialyser, no precipitate is formed on the parchment and the metallic hydroxide easily passes through. With similar solutions of beryllium and zinc hydroxides, the colloidal substance does not diffuse so readily and there is a precipitation of the hydroxide on the membrane; with chromium hydroxide, there is no diffusion. This is in agreement with Hantzsch's view (this vol., ii, 395) that aluminium, lead, and stannous hydroxides are acids, beryllium and zinc hydroxides are weak acids, and chromium hydroxide has no acid properties.

When the brown solution obtained by dissolving nickel sulphide in ammonium sulphide is subjected to dialysis, the nickel partially diffuses but there is a large deposit of nickel sulphide on the membrane. This shows that the solution is not a colloidal one in the ordinarily accepted interpretation of that term. J. McC.

**Constitution of the Compounds of Chromium. II.** By GRÉGOIRE N. WYROUBOFF (*Bull. Soc. Chim.*, 1902, [iii], 27, 719—733. Compare this vol., ii, 565).—When an aqueous solution of sulphochromic acid is heated, a coagulum is formed which has the composition of *chromium sulphochromate*,  $[\text{Cr}_2\text{O}_2(\text{OH})_4(\text{SO}_2)_4\text{O}_2(\text{OH})_2]\text{Cr}_2(\text{OH})_6$ , and is identical with\* that obtained by precipitating a violet salt of chromium in the cold with sulphochromic acid. If this is maintained for some time in contact with boiling water, it becomes hydrated, dissolves slowly, and finally passes entirely into a solution of the green sulphate. Chromium sulphochromate, when heated at  $120^\circ$ , becomes soluble in water and the solution yields insoluble precipitates with metallic salts, *chromosulphochromates* being formed. These the author considers as ethers of the green sulphate in which two hydroxyl radicles have been replaced by sulphochromic acid. On adding hydrochloric acid to a solution of chromium sulphochromate, *chromosulphochromic acid*,  $[\text{Cr}_2\text{O}_2(\text{OH})_4(\text{SO}_2)_4\text{O}_3, \text{Cr}_2\text{O}(\text{OH})_2(\text{SO}_2)_3(\text{OH})_6](\text{OH})_2$ , is precipitated as a dark green, gelatinous mass which dissolves in water, yielding an opalescent solution. On adding 2 mols. of sulphuric acid and a little water to 1 mol. of chromium sulphochromate, evaporating on the water-bath, and heating for some hours at  $120^\circ$ , *chromodisulphochromic acid*,  $[\text{Cr}_2\text{O}_2(\text{OH})_4(\text{SO}_2)_4\text{O}_3]_2[\text{Cr}_2\text{O}(\text{OH})_2(\text{SO}_2)_3(\text{OH})_4](\text{OH})_4, \text{H}_2\text{O}$ , is obtained, which yields an insoluble salt with iron. With sulphochromic acid, chromium sulphochromate yields a chromosulphodichromate.

If chromium sulphate is heated with an excess of sulphuric acid to a temperature not exceeding  $150^\circ$ , a clear green, gelatinous precipitate of sulphochromic acid is formed; on continuing the heating and at the same time allowing the temperature to rise, the green precipitate gradually changes into a heavy, greyish-yellow powder, soluble in water, yielding a milky, strongly acid solution. The same substance is obtained by heating sulphochromic acid for some time at  $250^\circ$ , and is the first anhydride of a polymeride of chromosulphochromic acid.

The author also points out that although sulphochromic acid forms insoluble compounds with the metals, it does not give precipitates with all the salts of the metals. Thus, it gives a precipitate with a solution of mercuric nitrate or acetate, but not with mercuric bromide. The author explains this by saying that the last-named salt is an anhydride and not a normal salt.

\* The author also gives details as to the method employed in the analysis of the compounds described. A. F.

**Colour Reaction of Uranium Salts with Hydrogen Peroxide.** By JULES F. ALOY (*Bull. Soc. Chim.*, 1902, [iii], 27, 734—735).—On adding to the solution of any uranium compound a little hydrogen peroxide and then potassium carbonate, either solid or in very con-

centrated solution, a fine red coloration is developed; on adding alcohol, the red compound is precipitated. This reaction may also be made use of for the detection of hydrogen peroxide. The red compound is very unstable, but the author has obtained apparently crystalline compounds of uranium by treating the solution with methyl instead of ethyl alcohol. A. F.

**Vanadium Silicide.** By HENRI MOISSAN and HOLT (*Compt. rend.*, 1902, 135, 78—81).—Vanadium silicide,  $\text{VSi}_2$ , is obtained by heating an intimate mixture of vanadium trioxide with a little more than five times its weight of silicon for about 2 minutes in an electric furnace with a current of 50 volts and 1000 amperes, and treating the residue successively with potassium hydroxide solution and strong nitric or sulphuric acid. It can also be obtained by reducing a mixture of silicon and vanadium trioxide with magnesium. It forms brilliant prisms which have a metallic lustre and a sp. gr. of 4.42, scratch glass, and melt and volatilise in the electric furnace. Alkalis and acids, with the exception of hydrofluoric acid, have no action on it, but it burns in fluorine, chlorine, or bromine when heated. Iodine vapour, oxygen, sulphur, and hydrogen sulphide attack it very slowly at the melting point of glass, but hydrogen chloride converts it into silicochloroform and vanadium chloride. Fused alkali hydroxides decompose the silicide; the action of fused metals depends on whether they combine more readily with silicon or with vanadium. Copper, for example, yields copper silicide and a copper vanadium alloy. C. H. B.

**Liquid Hydrosol of Gold.** By ALEXANDER GUTBIER (*Zeit. anorg. Chem.*, 1902, 31, 448—450).—A pseudo-solution of gold is obtained by reducing a very dilute solution of auric chloride with hydrazine hydrate in the cold. When the reduction is properly carried out, the solution is blue and keeps well, but when an excess of hydrazine is added the gold quickly separates.

By this reduction process, pseudo-solutions of silver, copper, lead, selenium, and tellurium can also be prepared. J. McC.

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## Mineralogical Chemistry.

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**Large Crystals of Carnallite from Beienrode.** By HUGO BÜCKING (*Jahrb. Min.*, 1902, ii, Ref. 12; from *Sitzungsber. K. Akad. Wiss. Berlin*, 1901, 539—542).—A description, with goniometric and optical measurements, is given of wine-yellow crystals of carnallite, which measure 8 cm. long and 6 cm. thick. Analysis, by Kleinfeldt, gave:

Mg.	K.	Cl.	H <sub>2</sub> O.	Total.
8.80	13.51	38.16	39.53	100.00

L. J. S.



**Arsensulfurite.** By FRIEDRICH RINNE (*Centr. Min.*, 1902, 499—500).—This new mineral substance occurs as a very thin, brownish-red incrustation on andesitic lava from the active volcano of Papandajan in Java. The surface is usually smooth and bright, but sometimes the material is vesicular. Thin splinters are reddish-yellow and optically isotropic. Analysis by Y. Buchholz shows it to contain: S, 70·78; As, 29·22 per cent. For naturally occurring amorphous sulphur the name *sulfurite* is proposed, and for the arsenical variety now described, *arsensulfurite*.  
L. J. S.

**Mineralogical Notes.** By ALBERT H. CHESTER (*Jahrb. Min.*, 1902, i, Ref. 360—361; from *Ann. Rep. State Geologist, New Jersey*, for 1900, 1901, 175—188).—Notes are given of various minerals from New Jersey, and analyses of the following. Fahlerz (I) as small masses, with calcite and dolomite, at Southtown. Jamesonite (II) as lamellar masses, on Jenny Jump Mountain.

	Sb.	Cu.	Fe.	Zn.	Bi.	Pb.	S.	Cl.	CaO.	MgO.	SO <sub>3</sub> .	Insol.	Total.
I.	15·90	45·20	5·70	1·10	0·22	—	23·23	0·29	1·04	0·30	3·43	3·84	100·30
II.	29·60	—	—	—	—	52·16	15·79	—	—	—	—	1·29	98·82

A cupriferous ochre (III) as a dark-brown, powdery substance, resembling wad, occurs with copper ores at Bound Brook. Vesuvianite (?) (IV) as white, granular masses, with garnet and axinite at Franklin Furnace; sp. gr. 2·78; lustre, pearly. Deweylite (V) as yellowish-brown crusts on serpentine at Hoboken.

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	CuO.	MnO.	CaO.	MgO.	K <sub>2</sub> O.
III.	58·00	20·50	8·30	2·52	3·30	1·80	0·14	1·36
IV.	39·03	16·43	3·19	—	3·68	29·88	0·30	—
V.	38·20	0·80	0·94	—	—	4·76	31·32	—

	Na <sub>2</sub> O.	H <sub>2</sub> O at 100°.	H <sub>2</sub> O ignition.	SO <sub>3</sub>	B <sub>2</sub> O <sub>3</sub> .	Cl.	CO <sub>2</sub> .	Total.
III.	0·58	1·86	1·54	—	—	—	—	99·90
IV.	—	0·22	6·61	0·07	0·28	—	—	99·74
V.	—	7·67	12·09	0·11	—	0·15	3·70	99·74

L. J. S.

**Koenenite.** By FRIEDRICH RINNE (*Centr. Min.*, 1902, 493—499).—This new mineral was found, intimately associated with halite, anhydrite and carnallite, in crevices in the clay of the salt deposits at Volpriehausen, in the Sollinger Wald, Hanover. It is red in colour, owing to enclosed scales of hæmatite, and has a perfect micaceous cleavage. Distinct crystals, which belong to the rhombohedral system, are rare, the mineral usually occurring as scaly crusts. It is optically uniaxial and positive; sp. gr. 1·98. After deducting halite (about 15 per cent.) and carnallite, the following analyses (I, by Sundmacher; II, by Y. Buchholz) give the formulæ  $\text{Al}_2\text{O}_3, 3\text{MgO}, 2\text{MgCl}_2, 8\text{H}_2\text{O}$  and  $\text{Al}_2\text{O}_3, 3\text{MgO}, 2\text{MgCl}_2, 6\text{H}_2\text{O}$  respectively.

	Al <sub>2</sub> O <sub>3</sub> .	MgO.	MgCl <sub>2</sub> .	H <sub>2</sub> O.
I.	17·79	21·10	35·70	25·41
II.	18·25	23·44	36·85	21·46

When heated in water for 80 hours, koenenite leaves a residue having the composition  $\text{Al}_2\text{O}_3, \text{MgO}, \text{H}_2\text{O}$ . By prolonged heating with ammonium chloride solution, it yields  $\text{Al}_2\text{O}_3, 2\text{H}_2\text{O}$ , and this on ignition gives anhydrous alumina. All these secondary products ("meta-koenenites") retain the scaly form of the original mineral, and are optically uniaxial but negative.

L. J. S.

**Uraninite from Joachimsthal.** By F. JANDA (*Chem. Centr.*, 1902, ii, 150; from *Oesterr. Zeit. Berg-Hütt.*, 50, 283—288).—General notes are given of the history and mode of occurrence of pitchblende at Joachimsthal, Bohemia, and of the technical applications of uranium for colouring glass, &c. The following analysis is given of a sample of ore; in some samples, the amount of  $\text{U}_3\text{O}_8$  reaches 79.2 per cent.

$\text{U}_3\text{O}_8$ .	$\text{As}_2\text{S}_3$ .	$\text{PbS}$ .	$\text{PbO}$ .	$\text{Cu}_2\text{S}$ .	$\text{Bi}_2\text{S}_3$ .	$\text{Ag}_2\text{S}$ .	$\text{Fe}_2\text{S}_3, \text{FeS}_2$ .	$\text{Fe}_2\text{O}_3$ .	$\text{FeCO}_3$ .
49.949	0.711	1.848	0.250	1.115	0.308	0.040	7.928	1.136	6.960

$\text{Al}_2\text{O}_3$ .	$\text{ZnO}$ .	$\text{MnO}_2$ .	$\text{CaCO}_3$ .	$\text{CaSO}_4$ .	$\text{MgCO}_3$ .	$\text{MgSO}_4$ .	$\text{SiO}_2$ .	$\text{V}_2\text{O}_5$ .	$\text{H}_2\text{O}, \text{Na}_2\text{O}, \text{K}_2\text{O}, \text{P}_2\text{O}_5$ .
3.245	1.093	0.107	3.690	0.893	0.756	0.068	18.545	0.015	1.343

Also traces of lead sulphate, copper sulphate, nickel, molybdenum, tungsten, polonium, radium and actinium; cobalt, fluorine and rare earths are absent.

L. J. S.

**Melanterite from Falun, Sweden.** By J. EDV. EDGREN (*Jahrb. Min.*, 1902, ii, Ref. 29; from *Geol. För. Förh.*, 1901, 23, 329).—A description is given of crystals of melanterite from the workings of the Falun mine. Analysis, by L. G. Thomé, gave the following results, which correspond with the formula  $(\frac{6}{7}\text{FeO}, \frac{1}{7}\text{MgO})\text{SO}_3, 7\text{H}_2\text{O}$ :

$\text{FeO}$ .	$\text{MgO}$ .	$\text{SO}_3$ .	$\text{H}_2\text{O}$ .
22.27	1.87	29.19	45.79

L. J. S.

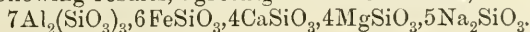
**A New Zeolite (Mooraboolite).** By G. B. PRITCHARD (*Victorian Naturalist*, 1901, 18, 63—65).—Cavities in the decomposed basalt, near Maude, in the Moorabool valley, Victoria, contain radial aggregates of a white to colourless mineral, which had previously been thought to be aragonite. The following characters, however, point to a zeolite allied to natrolite. Sp. gr. = 2.167—2.17; H = 6. The crystals show a long, rhombic prism terminated by a low pyramid; no cleavage is apparent. Analysis by E. O. Thiele gave:

$\text{SiO}_2$ .	$\text{Al}_2\text{O}_3$ .	$\text{CaO}$ .	$\text{Na}_2\text{O}$ .	$\text{K}_2\text{O}$ .	$\text{H}_2\text{O}$ .	Total.
48.024	28.684	0.42	11.239	3.001	9.8	101.68

L. J. S.

**Jadeitite from Cassine (Acqui).** By LUIGI COLOMBA (*Jahrb. Min.*, 1902, ii, Ref. 26; from *Riv. min. ital.*, 1901, 27, 18).—The material was found in the Bormida river. It shows, under the microscope, many pyroxene individuals which are partly altered to kaolin

and chlorite ; zircon, quartz and spinel (?) are rarely present. Analysis gave the following results, agreeing with the formula,



SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	CaO.	MgO.	Na <sub>2</sub> O.	K <sub>2</sub> O.	Loss on ignition.	Total.
55.98	18.02	trace	10.01	5.30	3.63	7.04	trace	0.27	100.27

L. J. S.

**Meteoric Iron from Surprise Springs, California.** By E. COHEN (*Mitth. naturwiss. Ver. Neu-Vorpommern u. Rügen*, 1902, 33, (1901), 29—33).—This iron, weighing 1524 grams, was found in 1899 at Surprise Springs, near Bagdad in San Bernardino Co. It is octahedral in structure. Sp. gr = 7.7308. Analysis gave :

Fe.	Ni.	Co.	Cu.	Cr.	S.	P.	C.	Cl.	Total.
91.01	7.65	0.89	0.07	0.04	0.08	0.22	0.02	0.02	100.00

L. J. S.

## Physiological Chemistry.

**'Survival' Respiration of Muscle.** By W. M. FLETCHER (*J. Physiol.*, 1902, 28, 354—359).—The early stages of *rigor mortis* which are marked by a steady output of carbon dioxide are incomplete in the absence of oxygen. The rate of output is lessened by about 30 per cent. in an atmosphere of nitrogen (prepared from urea) as compared with air. The output is largely increased (from 80 to 300 per cent.) in an atmosphere of oxygen.

W. D. H.

**Elaboration of Zymogen in the Gastric Glands of the Viper Berus.** By L. LAUNOY (*Compt. rend.*, 1902, 135, 195—197).—The elaboration of the zymogen grains is endonuclear ; the formation of the grains in the gastric cells is independent of all reflex or mechanical action and takes place when the digestive tract has been left in a state of rest by starvation. The transformation of the zymogen into an enzyme is carried out in the cytoplasm and is due to some exciting external cause.

J. McC.

**The Mechanism of Pancreatic Secretion.** By W. M. BAYLISS and ERNEST H. STARLING (*J. Physiol.*, 1902, 28, 325—353. Compare this vol., ii, 275).—A full account of the experiments previously published. The nature of secretin and prosecretin is not yet determined. Secretin causes some increase in the flow of bile, but does not act on any other glands except the pancreas and liver. Acid extracts of the intestinal mucous membrane contain also a substance which produces a fall (not a rise, as erroneously stated in the previous abstract) of blood pressure. Secretin may be prepared free from this depressor substance by acting on desquamated epithelial cells with acid.

W. D. H.

**Action of Peptone and Secretin on the Pancreas.** By A. HERZEN and C. RADZIKOWSKI (*Compt. rend. Soc. Biol.*, 1902, 54, 507—509).—Intravascular injection of peptone in dogs acts on the pancreas only as a succagogue, whilst that of secretin acts both as a succagogue (increasing the flow of juice) and as a trypsinogen (that is, converting the zymogen of trypsin into the active enzyme). The internal secretion of the spleen acts in the same way on the zymogen in the pancreas itself; secretin or enterokinase acts normally in the intestine on the zymogen secreted as such by the pancreas.

W. D. H.

**Influence of Various Reagents on the Activity of Pancreatic Diastase.** By PAUL GRÜTZNER and M. WACHSMANN (*Pflüger's Archiv*, 1902, 91, 195—207).—Glycerol extracts of pigs' pancreas were employed, and their power to convert starch into sugar tested when various additions were made to the mixture. With increasing concentration, sodium chloride, bromide, and iodide first hasten and then lessen the action; sodium fluoride favours the action until a strength of 4 per cent. is reached, when it is no longer soluble. Alkalis and alkali salts act inhibitingly even in the weakest solutions. The sulphates of sodium, magnesium, and ammonium, and mercuric chloride are specific poisons for this ferment. Acids first increase and then lessen its action. The results are shown in the form of curves, and these are different for different acids. Chloroform, alcohol, ether, and thymol all act inhibitingly, especially the first-named. Among animals, the diastatic ferment of the pig is the most active, then follow the rat, rabbit, ox, sheep, and cat, in the order named.

W. D. H.

**Lymph Formation and Bile Secretion.** By ALEXANDER ELLINGER (*Beitr. chem. Physiol. Path.*, 1902, 2, 297—306).—From the experiments described, which consisted in observing the amount of bile poured out from a permanent fistula in dogs during the injection of lymphagogues (peptone, leech extract), the conclusion of Asher and Barbèra that there is a causal relationship between bile secretion and lymph formation is disputed.

W. D. H.

**Formation of Higher Fatty Acids from Sugar.** By A. MAGNUS-LEVY (*Chem. Centr.*, 1902, i, 1410; from *Arch. Anat. Physiol.; physiol. Abth.*, 1902, 365—369).—Great importance is attached to the fact that in autolysis of the liver small quantities of acetic and hexoic acids are formed. The lower acids are capable of forming the higher, acetaldehyde being regarded as an intermediate product. The following equations represent this in the case of lactic acid,  $9\text{C}_3\text{H}_6\text{O}_3 = 9\text{C}_2\text{H}_4\text{O} + 9\text{H}_2 + \text{CO}_2$ ;  $9\text{C}_2\text{H}_4\text{O} + 7\text{H}_2 = \text{C}_{18}\text{H}_{36}\text{O}_2 + 7\text{H}_2\text{O}$ . This is believed to explain the formation of fat from carbohydrate in the body.

W. D. H.

**Enterokinase and Secretin.** By LUCIEN CAMUS (*Compt. rend. Soc. Biol.*, 1902, 54, 513—515).—Enterokinase and secretin are not identical; one may be present without the other in extracts of the



intestine, and acid which changes prosecretin into secretin has no such influence in producing enterokinase. W. D. H.

**Kinases of Microbic Origin.** By C. DELEZENNE (*Compt. rend.*, 1902, 135, 252—255).—Certain bacterial growths are shown to be capable of producing an enzyme which acts on the pancreatic juice in the same way as does the enterokinase obtained by Pawloff from intestinal juice. W. D. H.

**Influence of the Spleen on Pancreatic Digestion.** By LAFAYETTE B. MENDEL and LEO F. RETTGER (*Amer. J. Physiol.*, 1902, 7, 387—404).—These experiments were undertaken with the view of testing the truth of the Schiff-Herzen hypothesis. Extracts of spleen, prepared from the organ when congested during digestion, increase the proteolytic power of the pancreas, both *in vitro* and *in vivo*. Defibrinated blood from the splenic vein has the same effect. Extracts of liver and pancreas have but little action in this direction. The precipitate produced by adding alcohol to splenic extracts contains a trypsinogenic substance. Extracts of the pancreas of dogs without a spleen are not always free from trypsin. Extirpation of the spleen produces, in fact, no interference with digestive or other functions. The "activating" influence of intestinal juice is most important. The physiological importance of the spleen in the process is questionable. W. D. H.

**The Proteolytic Enzyme of the Spleen.** By J. B. LEATHES (*J. Physiol.*, 1902, 28, 360—365).—The products of the action in an acid medium of the proteolytic enzyme found in the cell juice of the spleen of oxen are the same as those formed by trypsin in alkaline media, or those formed by the hydrolytic action of mineral acids. The physiological significance of such enzymes in metabolism is discussed. The fact that acid is favourable to its action fits in with Ehrlich's view that the reaction of the nucleus in living cells is acid. Intracellular proteid katabolism is probably a reversion of anabolism. The autolysis of proteid in muscles, spleen, &c., provides the heart and nervous system during starvation with identical substitutes for the digestive products of proteid food. W. D. H.

**The Influence of Muscular Work on Metabolism.** By IGO KAUP (*Zeit. Biol.*, 1902, 43, 221—255).—Three experiments on men are fully described; the influence of work on nitrogenous metabolism is *nil*. The amount of phosphoric acid secreted is less during work than during rest. W. D. H.

**Influence of abundant Proteid Food on Metabolism.** By OTTO FRANK and R. TROMMSDORFF (*Zeit. Biol.*, 1902, 43, 258—287).—The experiment was made on a dog. The influence of increased proteid nutriment on nitrogenous and carbonaceous metabolism is described in full. Attention is also paid to the production of heat. W. D. H.

**Trypsin.** By ERNST SALKOWSKI (*Zeit. physiol. Chem.*, 1902, 35, 545—549).—Polemical. The statement made by Kutscher that the formation of hexon bases is characteristic of tryptic action is disputed.  
W. D. H.

**A Ferment in Leucocytes and Lymph Glands which favours Tryptic Activity.** By C. DELEZENNE (*Compt. rend. Soc. Biol.*, 1902, 54, 283—285).—An extract of lymph glands or of leucocytes liquefies gelatin, but has no other action by itself on proteids. Added to pancreatic juice, it reinforces the action of trypsin in the same way as enterokinase.  
W. D. H.

**Behaviour of  $\alpha$ -Glucoheptose in the Animal Body.** By JULIUS WOHLGEMUTH (*Zeit. physiol. Chem.*, 1902, 35, 568—579).—Given to rabbits by the mouth, subcutaneously or intravenously, from 30—50 per cent. of  $\alpha$ -glucoheptose is excreted in the urine unchanged. After the animals had been starved and 6 grams of  $\alpha$ -glucoheptose given, the liver contained in these experiments 0.2, 0.36, and 0.48 gram of glycogen, and 0.42, 0.37, and 0.50 gram of sugar respectively.  
W. D. H.

**Fate of Uric Acid introduced into the Stomach.** By ERNST SALKOWSKI (*Zeit. physiol. Chem.*, 1902, 35, 495—513).—If uric acid is introduced into the stomach of dogs, a variable fraction (20—47 per cent.) is absorbed. Of this, a large part is excreted as allantoin, the rest as urea. In rabbits, it is mostly absorbed; a small part is excreted unchanged, a small part as allantoin, and the rest as urea. This conflicts with the results of Soetbeer and Ibrahim (this vol., ii, 337).  
W. D. H.

**Glycuronic Acid Excretion.** By PAUL MAYER (*Chem. Centr.*, 1902, i, 1408; from *Arch. Anat. Physiol.*; *Physiol. Abth.*, 1902, 342—347).—In rabbits in which artificial dyspnoea has been produced, large quantities of glycuronic acid are excreted, but there is no corresponding increase in the secretion of indole and phenol. The administration of large quantities of sugar produces the same result. The experiments of other workers on the subject are criticised.  
W. D. H.

**The Fate of Sodium Thiocyanate in the Organism.** By LEO POLLAK (*Beitr. chem. Physiol. Path.*, 1902, 2, 430—433).—In view of Raudnitz's statement that outside the body superoxydases decompose thiocyanates with the formation of hydrocyanic acid, experiments were made by giving both to animals and man, either by the mouth or subcutaneously, weighed amounts of sodium thiocyanate. In the course of a few days, it was practically all recovered from the urine unchanged. In the dog, none was found in the salivary glands or pancreas. The 'surviving' liver, like the living body, has also no power of decomposing thiocyanates.  
W. D. H.

**Excretion of Sodium Chloride after Extirpation of the Pancreas.** By RAPHAEL LÉPINE and MALTET (*Compt. rend. Soc. Biol.*, 1902, 54, 404—405).—In ordinary glycosuria, there is no increase of

sodium chloride in the urine, but an increase does occur in the glycosuria which follows extirpation of the pancreas. W. D. H.

**Influence of Phloridzin on the Elimination of Sodium Chloride.** By RAPHAEL LÉPINE and MALTET (*Compt. rend. Soc. Biol.*, 1902, 54, 404).—Small doses of phloridzin in dogs, insufficient to cause glycosuria, do not increase the amount of sodium chloride in the urine. Larger doses render the kidney more permeable, not only to sugar, but also to sodium chloride. W. D. H.

**The Relation of Adenine and Guanine in the Organism.** By ALFRED SCHITTENHELM (*Chem. Centr.*, 1902, i, 1306; from *Arch. exp. Path. Pharm.*, 47, 432—437).—Minkowski showed that, in dogs, feeding with adenine, in contradistinction to hypoxanthine, produces no increase of uric acid or allantoin excretion. Nevertheless, it produces poisonous symptoms, and the formation of calculi of uric acid and ammonium urate in the kidneys. The present research on rabbits shows that feeding with adenine produces no rise in uric acid excretion; 24.2 per cent. of the adenine given is excreted unchanged. Relatively large doses produce the same symptoms as in dogs. Guanine given to rabbits produces neither increase in purine excretion nor pathological changes in the kidneys. W. D. H.

**Effect of Compression of the Ureter on the Urine.** By M. PFAUNDLER (*Beitr. chem. Physiol. Path.*, 1902, 2, 336—343).—In dogs, the urine was collected from the ureter, which was then compressed, and the urine again examined. A few cases in man, in which such an observation was possible, are also given.

Under the influence of the compression the pressure rises, and the amount of urine increases, but its molecular concentration falls greatly, to a half or three-quarters that of the original. Four per cent. of this decrease is due to urea, 11 to sodium chloride, and the remaining 85 per cent. to substances not estimated, but probably of inorganic nature because of the great lessening of electrical conductivity. W. D. H.

**Glycogen of the Heart.** By PAUL JENSEN (*Zeit. physiol. Chem.*, 1902, 35, 514—524; 525—535).—The normal percentage of glycogen in the heart varies between 0.3 and 0.5. In starved dogs in which the amount of glycogen had sunk in the leg muscle to 1/10—1/30 of the normal, that in the heart had not as a rule diminished. The diaphragm behaves usually like the limb muscles in this respect. In one case, no glycogen was found in the heart, but, nevertheless, this organ continued to beat. In the liver, the percentage of glycogen in one case (17 days' inanition) was 2.4; in another (19 days) 0.08. The reserve glycogen of the heart is of obvious physiological significance. From observations in frogs, it is held that after the entire disappearance of glycogen from the heart (produced by doses of strychnine), the glycogen returns nearly to the normal even if no food is given. A colorimetric method with iodine for estimating small quantities of glycogen is described.

W. D. H.

**Glycogen during Inanition.** By EDUARD PFLÜGER (*Pflüger's Archiv*, 1902, 91, 119—134).—A dog was kept without food for 28 days. It had lost 24 per cent. of its weight, and was then killed. The glycogen reckoned as sugar was then estimated, with the following results :

Organ.	Weight of organ.	Grams of sugar obtained.
Liver.....	507 grams.	24.26
Muscles.....	13,130 „	20.75
Bones .....	— „	5.89
Skin .....	5100 „	1.40
Blood.....	2083 „	0.19
Other parts .....	2693 „	traces

If the loss of glycogen due to the necessary delay before the analysis was commenced, and the sugar from gluco-proteids are allowed for, probably 100 grams of sugar in all would have been obtainable from an animal in an advanced state of inanition.

W. D. H.

**Analysis of Nervous Tissue.** By N. ALBERTO BARBIERI (*Compt. rend.*, 1902, 135, 246—248).—The substances are divided into three groups, which are stated to be quite distinct ; (1) substances soluble in ether ; (2) substances soluble in ether-water ; and (3) the residue. The percentage of phosphorus in each is given as different, and is apparently considered to be a fixed value.

W. D. H.

**Iron in the Blood of the Newly-born.** By MAURICE NICLOUX and VAN VYVE (*Compt. rend. Soc. Biol.*, 1902, 54, 581—583).—The analytical results given in tabular form show that the amount of iron in the blood of those born at full term averages 0.45 gram per 1000 gram of blood ; for those born before full term, the proportion is very similar (0.47 : 1000). In cases where albuminuria exists, the proportion falls to 0.38 : 1000, and in fetuses born dead, it falls to half the normal.

W. D. H.

**Calcium and Magnesium in the Dog.** By JULES ALOY (*Compt. rend. Soc. Biol.*, 1902, 54, 604—605).—The analyses presented show that magnesium preponderates in the cells and 'noble' tissues, and that calcium preponderates in the connective or skeletal tissues. The importance of the former metal in living processes is believed to be greater than that of calcium.

W. D. H.

**Combination of Copper in the Liver.** By B. SLOWTZOFF (*Beitr. chem. Physiol. Path.*, 1902, 2, 307—311).—Previous researches have shown that, in the liver, arsenic unites with the nuclein, and mercury with the globulin. Copper also unites with the nuclein. The copper nucleinate is not affected by 2 per cent. solution of sodium hydroxide, but is decomposed by 0.3 per cent. hydrochloric acid, or by pepsin-hydrochloric acid.

W. D. H.

**Iron in Hen's Eggs.** By C. HARTUNG (*Zeit. Biol.*, 1902, 43, 195—212).—By giving iron oxide mixed with the food to hens, the



amount of iron in the eggs laid increases considerably after some months. Full analytical details are given. The disadvantage of these 'iron eggs' for therapeutic purposes is their expense. W. D. H.

**Ammonia and Lactic Acid in the Blood of Geese.** By KATH. KOWALEWSKY and SERGEI SALASKIN (*Zeit. physiol. Chem.*, 1902, 35, 552—567).—The amount of ammonia in the blood of geese is higher than in that of the dog, and is fairly constant. Administration of even large quantities of alkalis does not alter it much. It increases if poisonous doses of acid are given. On administration of alkalis, the alkalinity of the blood (Salkowski-Salaskin method) does not alter, excess being rapidly eliminated in the urine; it lessens if acids are given. In pathological cases, when the alkalinity of the blood is less than normal, administration of alkali raises the alkalinity, excess being retained in the blood, and it is not rapidly excreted. The estimations of lactic acid were not very numerous, but the results show that its amount is but little altered by giving either acid or alkali. Large doses of acid probably raise its amount; this is deduced from observations on gaseous metabolism.

The effects on the urine are as follows: alkalis increase the uric acid nitrogen, lessen the ammonia nitrogen, and leave the urea nitrogen practically unchanged. Acids diminish the uric acid nitrogen, increase the ammonia nitrogen, and slightly increase the urea nitrogen. In normal circumstances, urea is in great part converted into uric acid by birds. This change is not increased by alkalis, but is lessened by acids.

After giving alkalis, lactic acid appears in the urine. This is related to the interference produced on gaseous interchanges.

W. D. H.

**Glycuronic Acid in Dog's Blood.** By RAPHAEL LÉPINE and BOULUD (*Compt. rend.*, 1902, 135, 139—140).—Further experiments are adduced to show that the blood (and liver) of the dog contains conjugated glycuronic acid. The amount increases when the blood is defibrinated. Boiling in the presence of acid usually lessens the amount, owing to the easy way in which these compounds are broken up.

W. D. H.

**Variation in the Iodine of the Blood.** By EUGÈNE GLEY and PAUL BOURCET (*Compt. rend.*, 1902, 135, 185—186).—Iodine is stated to be a normal constituent of the blood. It is supposed to be of alimentary value and to originate in the thyroid. The amount is very variable. It is lessened and finally disappears after excessive bleeding, but on feeding reappears in 20 days. The observations recorded were made on dogs.

W. D. H.

**The Influence of Altitude on the Blood.** By EMIL ABDERHALDEN (*Zeit. Biol.*, 1902, 43, 125—194).—The observations were made on animals transferred from Basle to St. Moritz. The influence of the greater altitude in producing an increase in red corpuscles, in total hæmoglobin, and in hæmoglobin per corpuscle is supported by a large

amount of analytical evidence. The change occurs rapidly, and the reverse change takes place equally rapidly on a return to Basle. Histological alterations in the red corpuscles, and any difference in the iron reaction of the tissues, were not noted.

W. D. H.

**The Decomposition of Potassium Iodide in the Organism by Nitrites.** By A. STEPANOFF (*Chem. Centr.*, 1902, i, 1306; from *Arch. exp. Path. Pharm.*, 47, 411—416).—Various organs of the rabbit, when kept on milk, a food free from nitrates, show no nitrite reaction; but if nitrates are given also, they do. The reduction of nitrates to nitrites in the body is believed to be of a fermentative nature. The presence of nitrites is believed to be essential to the therapeutic value of potassium iodide.

W. D. H.

**Indoxyluria.** By FERDINAND BLUMENTHAL (*Chem. Centr.*, 1902, i, 1408; from *Arch. Anat. Physiol.*; *Physiol. Abth.*, 1902, 347—351).—Experiments on rabbits in inanition, and on various diets, show that with increased proteid katabolism, indoxyl appears in the urine, and the conclusion is drawn that the intervention of bacteria is not necessary for the production of indoxyl.

W. D. H.

**Influence of the Methyl Group on the Toxicity of various Organic Metallic Compounds.** By MARC LAFFONT (*Compt. rend. Soc. Biol.*, 1902, 54, 286—288).—Experiments were made on guinea-pigs regarding the toxicity of sodium dimethylarsinate and disodium monomethylarsinate, and the conclusion is drawn that the methyl group plays the part of a haptophore, to use Ehrlich's nomenclature; the presence of a second methyl group increases the production of free receptors, and the leucocytes will fix the metallic compound more readily, and so the toxicity of the compound is decreased.

W. D. H.

**Physiological Action of Organic Ammonium Iodides and Polyiodides.** By C. JACOB (*Chem. Centr.*, 1902, i, 1306; from *Nachr. k. Ges. Wiss. Göttingen*, 1902, 108—113).—Rosenbach stated that tetramethylammonium tri-iodide gives clinically favourable results in the treatment of wounds, when used in small quantities instead of iodoform. The present research shows that, in animals, this substance in large doses produces toxic symptoms resembling those caused by curare and muscarine. Tetramethylammonium iodide, and valeryl- and isoamyl-trimethylammonium chloride produce the same symptoms. Tetraethylammonium tri-iodide has the same local action as the methyl compound, but produces none of the poisonous effects.

W. D. H.

**Physiological Action of Borax and Boric Acid; its Use as a Preservative of Foods.** By E. ROST (*Chem. Centr.*, 1902, ii, 139—140; from *Arb. Kais. Ges. A.*, 19, 1—70). By MAX RUBNER (*ibid.*, 140—141; from *ibid.*, 70—88). By R. O NEUMANN (*ibid.*, 141; from *ibid.*, 89—96). By ARTHUR HEFFTER (*ibid.*, 141; from *ibid.*, 97—109). By EDUARD POLENSKE (*ibid.*, 141—142; from *ibid.*, 167—168).—The

general effect of these extensive experiments is to show the harmful effects of borax and boric acid, even in such quantities as are used in preserving foods.

W. D. H.

**Antitoxic Effect of Ions.** By HUGH NEILSON (*Amer. J. Physiol.*, 1902, 7, 405—408).—Small amounts of salts with uni-, bi-, or tri-valent kations diminish the poisonous effect of the chlorides of sodium, lithium, ammonium, and potassium on voluntary muscle; figures are given where the best results are obtained. Sodium salts with anions of higher valency when added to solutions of sodium or lithium chloride have no antitoxic effect, but have a slight antitoxic effect when added to solutions of ammonium or potassium chloride.

W. D. H.

**The Effect of Calcium and of Free Oxygen on Rhythmic Contraction.** By S. S. MAXWELL and J. C. HILL (*Amer. J. Physiol.*, 1902, 7, 409—411).—The ciliated cells of the frog's œsophagus remain active in  $1/8$  *N*-calcium chloride solution for many hours. The average duration of activity in boiled solutions was 31 hours; in solutions saturated with oxygen, 20 hours. The oxygen factor has been hitherto neglected in such experiments, and may explain some discrepancies.

W. D. H.

**Oxidative Properties of the Cell-nucleus.** By RALPH S. LILLIE (*Amer. J. Physiol.*, 1902, 7, 412—421).—A general similarity exists between the distribution of nuclear matter in the various tissues of the frog, and the distribution of coloured synthetical products formed within the same tissues by their oxidative action. In a number of instances, especially liver, kidney, and blood corpuscles, the coloured products are deposited chiefly in and about the nucleus, especially at the surface of contact between the nucleus and the cytoplasm.

W. D. H.

**Artificial Parthenogenesis in Annelids.** By MARTIN H. FISCHER (*Amer. J. Physiol.*, 1902, 7, 301—314).—Experiments on *Amphitrite* and *Nereis* confirm Loeb's hypothesis that the spermatozoon does not act as a stimulus to the egg that starts its development, but as a catalyser which accelerates a process that starts of its own accord.

W. D. H.

**Antiurease.** By LEOPOLD MOLL (*Beitr. chem. Physiol. Path.*, 1902, 2, 344—354).—This is a research in which the question was investigated whether the enzyme of the *Micrococcus ureae* is capable of stimulating the production of an anti-substance as so many other enzymes do. Normal serum has some inhibiting influence on the ferment, but this varies, and is not due to inorganic salts. Immunisation was produced by gradually increasing injections in animals, and the serum became strongly inhibitory in its action. The antiurease to which this is due is destroyed by heating for an hour at  $65^{\circ}$ , but not at  $56^{\circ}$ .

W. D. H.

**A Fibrinogenous Substance in Egg-white.** By ARMAND GAUTIER (*Compt. rend.*, 1902, 135, 133—139).—It is well known that, on agitation, white of egg deposits a precipitate which has many of the solubilities of fibrin, and is membranous. The present communication advances the theory that the formation of this fibrin-like material is analogous to that of fibrin-formation in blood in being due to ferment activity. Agitation is stated not to be necessary. W. D. H.

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## Chemistry of Vegetable Physiology and Agriculture.

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**The Zymase of Eurotiosis Gayoni.** By PIERRE MAZÉ (*Compt. rend.*, 1902, 135, 113—116).—The zymase of *Eurotiosis Gayoni* develops only in presence of air. The proportion of zymase for a given quantity of mycelium varies considerably, but is highest in young cultivations and disappears as the growth of the organism proceeds. C. H. B.

**The Nitrogenous Constituents of Certain Fungi.** By ERNST WINTERSTEIN and J. HOFMANN (*Beitr. chem. Physiol. Path.*, 1902, 2, 404—410).—The main fungus investigated was *Boletus edulis*, but *Agaricus campestris*, and *Cantharellus cibarius* were also examined. The residue, obtained from an extract made with light petroleum, consists largely of proteid. By decomposition with acids, hexon bases were obtained. W. D. H.

**Effect of Kainite as Manure on the Germination and Growth of Various Plants.** By KARL ENNENBACH (*Bied. Centr.*, 1902, 31, 559—565; *Inaug. Diss. Bâle*, 1901).—The results of experiments with various plants showed that kainite supplies potassium in a readily available form and that any injurious action it may have is not due to impurities, but probably to its action on the physical properties of the soil. N. H. J. M.

**Relation of Calcium and Magnesium to Plant Growth.** By OSCAR LOEW and D. W. MAY (*Bied. Centr.*, 1902, 31, 552—553; from *Bul. Bur. Plant Ind. U.S. Dept. Agric.*, 1901, No. 1).—Calcium is required by plants in producing nucleo-albumin compounds and is deposited in the plant. Magnesium acts as a carrier of phosphoric acid and is migratory, the same quantity exercising its functions over and over again. Excessive assimilation of calcium hinders the assimilation of phosphoric acid owing to the production of calcium phosphate in the place of magnesium phosphate. In the case of some plants, the excess of calcium is rendered harmless by being precipitated as oxalate or carbonate.

When magnesium is present in excess, it may take the place of calcium in the nucleo-albumin compounds. Only very few plants have



the power of rendering magnesium compounds insoluble, but its injurious effects can be prevented by supplying an excess of calcium.

The results of analyses of soils from all parts of the world showed that whilst the relations of calcium and magnesium vary greatly, most soils, and all fertile ones, contain more calcium than magnesium.

Of the different plants in which magnesium has been determined, sugar beet (roots, leaves, and seeds) contains the highest percentage.

N. H. J. M.

**Relation of Calcium and Magnesium to Plant Growth.** By D. W. MAY (*Bied. Centr.*, 1902, 31, 554—555; from *Bul. Bur. Plant Ind. U.S. Dept. Agric.*, 1901, No. 1).—In water-culture experiments with various plants, the presence of 0·1 per cent. of soluble magnesium compounds killed the plants. The same amount of magnesium was without effect in presence of 0·2 per cent. of calcium.

Plants grown in sand were greatly injured by 1 per cent. of magnesium. The poisonous action was prevented by adding gypsum, but not by calcium carbonate.

In experiments with sandy loam, it was found that oats and beans grew best in presence of 0·8 per cent. of lime and 0·2 per cent. of magnesia (both as carbonate); less than 0·6 per cent. of lime, with more than 0·4 per cent. of magnesia, caused the destruction of the plants. When, however, the calcium was applied as sulphate, the plants grew well.

N. H. J. M.

**Action of Inorganic Salts on the Development and Form of Plants.** By GEORGE H. PETHYBRIDGE (*Bied. Centr.*, 1902, 31, 556—558; from *Inaug. Diss. Göttingen*, 1899).—Sodium chloride, when added to normal nutritive solutions in which wheat was grown, produced the same effect as dilution, reducing the diameter of the roots and stems and increasing the thickness of the cells of the endoderm and of the central cylinders of the roots, stems, and leaves, as well as the absolute number of fibres in the leaves. Similar results were obtained with maize and oats.

Calcium salts promote root development. Whilst potassium nitrate was favourable, and calcium chloride injurious, to growth, the two salts together were very beneficial.

In pot experiments in which oats and wheat were grown in garden soil, it was found that absence of moisture resulted in a considerable reduction in the amount of roots and in the height of the plants.

N. H. J. M.

**Action of Potassium on Plant-life.** By H. WILFARTH, G. WIMMER, H. RÖMER, E. MAYER, F. KATZ, and G. GEISTHOFF (*Chem. Centr.*, 1902, i, 1304; from *Arbeit. d. Deut. Landw. Ges.*, 68, 1—106).—The experiments relate to the influence of potash and potassium salts on the life and growth of several plants (potatoes, tobacco, mustard, oats, &c.).

W. D. H.

**Respiration of Resting Plants.** By R. KOLKWITZ (*Bied. Centr.*, 1902, 31, 573—574; from *Ber. deut. bot. Ges.*, 1901, 19, 285).—The

intensity of the respiration of dried barley grains was determined by measuring the expired carbon dioxide. Respiration, which was very slight when the amount of water was 10—11 per cent., increased considerably with 20 per cent. of water, whilst with 33 per cent. of water there was an evolution of 2000 c.c. of carbon dioxide per kilogram in 24 hours, an amount which could be much increased by raising the temperature and the percentage of oxygen in the air.

Crushed grain showed increased respiration, whilst grain which had been ground to coarse meal respired even after being heated for several hours at 100° and again moistened. The power of respiration was destroyed by thymol water and by mercuric chloride, but not by 96 per cent. alcohol or by toluene.

N. H. J. M.

**Decomposition of Carbon Dioxide by Insolated Leaves.** By PIERRE P. DEHÉRAIN and EM. DEMOUSSY (*Compt. rend.*, 1902, 135, 274—275).—The decomposition of carbon dioxide by detached leaves is readily demonstrated in the following manner. A bell jar (150—200 c.c.) containing the leaves is inverted over a saturated solution of carbon dioxide in such a manner as to remove all the air except about 50 c.c.; it is then completely immersed in a jar filled with a solution of carbon dioxide. The initial height of the liquid in the bell jar being marked, the increase in the volume of the gas is readily seen. The production of oxygen is finally shown by means of a glowing straw.

The results of several experiments showed that the volume of oxygen exactly equalled that of the carbon dioxide consumed, no hydrogen, carbon monoxide, or other compounds being produced.

N. H. J. M.

**Chlorophyllous Assimilation in Leaves when the Upper or Under Sides are Exposed to Light.** By ED. GRIFFON (*Compt. rend.*, 1902, 135, 303—305).—Assimilation varied considerably according to the side of the leaves exposed to light, being greater when the upper surface is exposed. The differences were, however, not so great as those observed by Boussingault. The differences are greatest in the case of thick leaves, and when the surfaces are exposed to direct sunlight. Under natural conditions, when the one surface is exposed to direct and the other to diffused light, the differences are only slight.

The results, indicating that the parenchyma is adapted to the function of assimilation, are probably explained by the hypotheses of Stahl and Haberlandt.

N. H. J. M.

**A Permanent Action which tends to produce a Negative Tension in the Vessels of Wood.** By H. DEVAUX (*Compt. rend.*, 1902, 134, 1366—1369).—The lower pressure in wood cells as compared with that of the air is partly due to the volume of the carbon dioxide produced being less than that of the oxygen consumed. This respiratory action is relatively slight, but it is unceasing.

N. H. J. M.

**Migration in Woody Plants.** By GUSTAVE ANDRÉ (*Compt. rend.*, 1902, 134, 1514—1517).—The results of analyses of horse chesnut

stems and leaves at four different periods, from 29th July to 16th November, showed that in the stems the total ash increased at first and then remained nearly constant, whilst in the leaves there was a progressive increase. Both potassium and phosphoric acid increased in the stems, and it is suggested that this migration from the leaves may extend to the older branches. Calcium increased both in stems and in leaves.

The total nitrogen increased during the whole period in the stems. In the leaves, there was an increase of nitrogen followed by a decrease. The saccharifiable carbohydrates increased in the stems from the first to the second period, after which they decreased, whilst the cellulose continued to increase until the end of the experiment. In the case of the leaves, both the saccharifiable carbohydrates and the cellulose decreased during the first period and increased again during the second.

N. H. J. M.

**Presence of Lecithin in Vegetables.** By CHARLES F. SCHLAGDENHAUFFEN and E. REEB (*Compt. rend.*, 1902, 135, 205—208).—The quantity of lecithin in vegetables has been variously given by different authors. The cause of this is to be found in the method of extraction. In the light petroleum, ether, or ether-alcoholic extract, the authors have identified calcium and manganese phosphates, and they attribute this to the formation of a soluble metallic glycerophosphate from the ordinary phosphate present in the soil.

J. McC.

**Presence of Rennet in Plants.** By MAURICE JAVILLIER (*Compt. rend.*, 1902, 134, 1373—1374).—The sap of *Lolium* yielded a substance having all the properties of rennet. The substance occurs in large numbers of plants, and was obtained from the following varieties: *Anthriscus vulg.*, *Plantago lanceolata*, *Capsella Bursa pastoris*, *Geranium molle*, *Ranunculus bulbosus*, *Medicago lupulina*, *Lamium hybridum*, *L. amplexicaule*, and *Philadelphus coronarius*.

N. H. J. M.

**The Amount of Nicotine, Wax, Resin, and Non-volatile Organic Acids in Tobacco Leaves at different Periods in the Growth of the Latter.** By RICHARD KISSLING (*Chem. Zeit.*, 1902, 26, 672—673).—The following percentages were obtained in the dry tobaccos:

	1.	2.	3.	4.	5.	6.	7.
Wax .....	0.414	0.331	0.444	0.378	0.270	0.248	0.297
Nicotine .....	0.15	0.21	0.36	0.45	—	0.54	0.60
Resin soluble in light petroleum.	1.90	1.89	1.99	1.92	2.78	2.40	2.01
„ „ ether .....	0.71	1.00	0.71	0.51	0.91	0.68	0.75
„ „ alcohol.....	2.35	2.85	2.54	1.13	4.26	2.67	3.21
Citric acid (anhydrous) .....	3.41	5.80	5.75	5.79	—	5.90	4.73
Malic acid „ .....	4.98	6.34	6.08	6.21	—	5.17	5.36
Oxalic acid „ .....	1.51	1.89	1.93	1.95	—	1.98	2.13

The first sample represented the tobacco at the time the young plants were bedded out; 2, after the leaves had formed; 3, shortly

before full-growth; 4, just after full-growth; 5, ready for gathering; 6, after gathering, and already dried; and 7, the fermented tobacco.

W. P. S.

**Necessity of Lime for Seedlings, especially at Higher Temperatures.** By LEOPOLD VON PORTHEIM (*Bied. Centr.*, 1902, 31, 574—575; from *Bot. Centr.*, 1901, 88, 282).—In opposition to Dehérain's statement that germinating beans develop completely in absence of calcium at a temperature of 30—35°, it was found in every case impossible to obtain complete development under these conditions, the seedlings as a rule drying at an earlier stage than when germination took place at the ordinary temperature in absence of calcium.

The injurious effects observed when calcium is absent were shown by Schimper to be due to the presence of potassium hydrogen oxalate. When the injured portions are brushed over with a solution of calcium nitrate, new roots are produced.

N. H. J. M.

**Soil Phosphates soluble in Water.** By TH. SCHLOESING, jun. (*Compt. rend.*, 1902, 134, 1383—1385).—Four different soils which were kept damp for four months were found to contain more phosphoric acid soluble in water than samples of the same soils which had remained in a dry condition.

In the case of manured soils, the soluble phosphoric acid will be chiefly derived from the phosphates supplied in the manure. Aqueous extracts of two samples of Rothamsted wheat soil,\* the one unmanured and the other supplied with mineral manure, yielded 7 and 109 milligrams of phosphoric acid respectively per kilogram of soil. The same samples contained 0.09 and 0.19 per cent. of phosphoric acid soluble in boiling hydrochloric acid.

N. H. J. M.

**Composition of Cow's Milk.** By L. MOERMAN (*Chem. Centr.*, 1902, ii, 138; from *Bull. Assoc. Belge chimistes*, 16, 147—151).—The object of the experiments was to ascertain the effect of work on the composition of cow's milk. Work lessens the amount of milk secreted, and raises the proportion of its solid constituents, but the results are not very definite.

W. D. H.

**Variation in [the Amount of] Phosphoric Acid according to the Period of Lactation.** By FRED. BORDAS and SIG. DE RACZKOWSKI (*Compt. rend.*, 1902, 135, 302—303).—The greatest amounts of phosphoric acid, lecithin, and glycerophosphoric acid are found in milk produced in the first month after calving, after which the quantities (percentage as well as actual) gradually decrease.

N. H. J. M.

\* The samples referred to were taken from Plot 3 and Plot 5 of Broadbalk Field in 1893 (October), and represent the first 9 inches of soil.



## Analytical Chemistry.

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**Gas Analysis by Combustion.** By WALTHER HEMPEL (*Zeit. anorg. Chem.*, 1902, 31, 445—447).—Combustion of methane with oxygen by explosion gives satisfactory results only when the mixture explodes neither too violently nor too feebly; it is, however, complete provided that a correct amount of oxygen has been added. It has been found that a mixture of methane and air may be passed several times through a red hot platinum capillary tube or over a red hot platinum spiral without complete combustion taking place; results obtained by this method can only be satisfactory if a large excess of oxygen is present or if hydrogen is added in order to make the mixture explosive (compare Gautier, *Abstr.*, 1900, ii, 469, 537).

J. McC.

**[Determination of Iodine in Solutions containing Iodine and Hydriodic Acid.]** By C. H. L. SCHMIDT (*Zeit. physiol. Chem.*, 1902, 35, 386—395).—A modified method for estimating hydriodic acid and iodine in the filtrates from iodinated proteids is described; it consists in estimating the free iodine by the aid of thiosulphate and the total iodine ( $I_2 + HI$ ) by the aid of standard silver nitrate.

It has been found that sodium thiosulphate reacts with iodic acid according to the equation  $10HIO_3 + 11Na_2S_2O_3 = 2NaI + 8NaIO_3 + Na_2S_2O_6 + 4Na_2S_4O_6 + Na_2SO_4 + 3S + 5H_2O$ , and a solution of the acid may therefore readily be standardised by the aid of *N*/20 thiosulphate (1 c.c. = 0.0079 gram iodic acid).

J. J. S.

**Estimation of Total Phosphoric Acid in Basic Slags.** By CAMILLE ASCHMAN (*Chem. Zeit.*, 1902, 26, 823).—A slight but essential modification of the method formerly proposed (*Abstr.*, 1899, ii, 807). The solution resulting from the treatment of the powdered slag with dilute nitric and sulphuric acid is filtered immediately instead of after 12 hours. Fifty c.c. of the filtrate are then at once mixed with 10 c.c. of the citric acid solution so as to prevent precipitation of calcium compounds. On adding ammonia previous to the magnesia mixture, the liquid should remain perfectly clear; should a flocculent precipitate of silicic acid form, the estimation should be repeated by another method, but this very rarely occurs. It sometimes happens that the liquid turns black after neutralisation or during the action of the magnesia mixture, but this colour gradually disappears on stirring. After stirring for 40 minutes, an hour or two should elapse before the precipitate is collected.

L. DE K.

**Analysis of Superphosphates.** By J. LEGRAND (*Chem. Centr.*, 1902, ii, 156; from *Bull. Assoc. Belge chimistes*, 16, 143—144).—In the analysis of superphosphates, it is frequently noticed that the filtrate after some time becomes turbid and opalescent. This precipitate, which disappears on adding a little nitric acid, is neither calcium

sulphate nor dicalcium phosphate, but consists chiefly of ferric phosphate with not more than 6—7 per cent. of aluminium phosphate, and a small quantity of ferrous phosphate. The precipitate is slowly soluble in ammonium citrate solution. L. DE K.

**Volumetric Estimation of the Double Phosphates of Ammonium with Cadmium, Cobalt, Manganese, and Zinc.** By HENRY D. DAKIN (*Zeit. anal. Chem.*, 1902, 41, 279—289).—Stolba's method for the volumetric estimation of magnesium ammonium phosphate (*Chem. Centr.*, 1866, 727) can be used with advantage for titrating the above double phosphates.

The precipitate is dissolved in an excess of *N*/10 sulphuric acid and the total acid titrated with *N*/10 sodium hydroxide, using methyl-orange as indicator. The change of colour occurs when the phosphoric acid is converted into a dihydric phosphate. The mode of precipitation should be that laid down by the author and by Miller and Page (*Abstr.*, 1900, ii, 624; 1901, ii, 131; this vol., ii, 49), but cadmium must be precipitated in the cold, since the precipitate will be deficient in ammonia if thrown down from a hot solution. The titration should take place at a temperature not exceeding 25°, and in the case of cobalt the solution to be titrated should not contain more than 0.1 gram of the double salt in 100 c.c. M. J. S.

**Colorimetric Estimation of Arsenious Acid.** By J. MAI (*Zeit. anal. Chem.*, 1902, 41, 362—365).—Arsenious acid is heated with fuming hydrochloric acid in a slow current of dry carbon dioxide, and the arsenious chloride which distils over converted into sulphide by impinging on the surface of a piece of calico wetted with a strong aqueous solution of hydrogen sulphide. The calico is tied over the mouth of a funnel-shaped vessel, which is inverted in the basin containing the hydrogen sulphide solution, and just touches the surface of the liquid. It is necessary to pierce a few holes in the calico with a needle to allow the carbon dioxide to escape freely, otherwise the pressure of the gas forces the precipitate through the fabric. It is important to avoid distilling over aqueous hydrochloric acid with the arsenious chloride. With amounts of from 0.1 to 0.6 mgm. of arsenious oxide, differences of 0.1 mgm. are easily distinguished. M. J. S.

**The Marsh-Berzelius Arsenic Deposit.** By WILLIAM ACKROYD (*J. Soc. Chem. Ind.*, 1902, 21, 900—901).—To obtain uniformly brown deposits of arsenic, the current of hydrogen should be slow, combined with a sparing evolution of arsenic hydride, the latter condition being brought about by the gradual addition of the arsenical substance to the Marsh apparatus. The rate of the hydrogen current may be judged by the size of the flame at the open end of the tube. Blue deposits of arsenic were usually observed when inorganic substances were tested, and the author concludes that in this state the particles are larger than in the brown deposits. W. P. S.

**Methods for Arsenic Estimation in Malt Liquors, &c.** By FREDERIC W. RICHARDSON (*J. Soc. Chem. Ind.*, 1902, 21, 901—903).—The

author prefers a modification of the Gutzeit test to the Marsh-Berzelius method, and chars the malt liquor with a mixture of sulphuric and nitric acids, removing the latter by evaporation and the addition of ferrous sulphate when fuming commences, before applying either test. The sulphuric acid used is freed from arsenic by adding 1 per cent. of nitric acid and distilling. In some experiments, using a pure solution of arsenious acid, no deposit could be obtained in the Marsh tube, although the escaping gases gave a stain on mercuric chloride paper.

W. P. S.

**Two Possible Causes of Discrepancy in Arsenic Analysis.** By A. J. MURPHY (*J. Soc. Chem. Ind.*, 1902, 21, 957—958).—The writer states that the sensitiveness of the sulphuric acid employed in the Marsh-Berzelius test varies from day to day, and that the longer it is exposed to atmospheric oxygen the less sensitive it becomes. Another source of error is that when arsenic is present in both the -ic and -ous forms, the deposit appears more slowly than usual. The remedies are to prepare fresh standards frequently and to allow a blank to run the same length of time as the apparatus containing the arsenical substance.

W. P. S.

**Gosio's Biological Method for the Detection of Arsenic and the Formation of Organic Arsenic, Selenium, and Tellurium Compounds by the Action of Fungi and Bacteria.** By ALBERT MAASSEN (*Chem. Centr.*, 1902, i, 1245—1246; from *Arb. Kais. Ges.-A.*, 18, 475—489. Compare Gosio, *Abstr.*, 1897, ii, 381; Abba, *Centr. Bakt. Par.*, ii, 4, 806; Morpurgo and Brunner, *Oesterr. Apoth.-Zeit.*, [ii], 1, 167; Schmidt, *Diss. Erlangen*, 1899; Abel and Buttenberg, *Abstr.*, 1900, ii, 299).—The solid compounds of selenium and tellurium are attacked by *Penicillium brevicaulis*, forming volatile substances. The volatile selenium compound has a mercaptan-like odour, quite distinct from that of the arsenic compound, but cultures containing tellurium emit an odour resembling that of garlic. The test is best made by adding the sterilised aqueous solutions of the selenium or tellurium compounds to the sterilised nutritive medium. The sulphides and other insoluble compounds of selenium and tellurium, as well as the elements themselves, are not attacked by this mould, or only to a very slight extent after a great length of time, and in this respect these non-metals differ from arsenic. Selenium and tellurium compounds, on the other hand, are attacked by many fungi which do not affect arsenic derivatives. The volatile selenium and tellurium compounds are absorbed by a solution of mercuric chloride with separation of crystals (compare Biginelli, *Abstr.*, 1901, i, 20). Whilst in the animal organism selenium and tellurium compounds are converted into ethyl derivatives, in microbes, methyl derivatives are formed. The reducing property of the cells of animals and microbes is due to the presence of a substance which can exercise this power even when removed from the tissues, but the formation of methyl or ethyl derivatives seems, however, to be really dependent on vital processes occurring only in the organism.

The value of Gosio's test is scarcely affected by these results, since

selenium and tellurium compounds are very rarely met with, and a confirmatory test may be easily made with a microbic culture which attacks selenium and tellurium derivatives but not arsenic compounds.

E. W. W.

**Titration of Free Alkali in Presence of Nitrites.** By KURT ARNDT (*Zeit. anal. Chem.*, 1902, 41, 359—362).—At low temperatures, free ammonia can be titrated by standard acid in presence of the nitrites of ammonium or the alkali metals, using an aqueous solution of aurin as indicator. Carbonates must first be removed by barium chloride, and, in presence of barium, hydrochloric acid should be used for the titration. Litmus and methyl-orange may also be used, but the end reaction is sharpest with aurin.

M. J. S.

**Action of Carbon Dioxide on the Borates of Barium.** By LOUIS CLEVELAND JONES (*Amer. J. Sci.*, 1902, [iv], 14, 49—56. Compare Abstr., 1898, ii, 640).—On passing a current of carbon dioxide through an aqueous, or alcoholic, solution of barium hydroxide containing barium metaborate, the latter is decomposed with formation of boric acid. On evaporating the liquid, a portion of the acid is volatilised, and a further amount is lost when the residue is heated at a high temperature to effect the formation of the barium metaborate. The action of boric acid on barium carbonate is but very incomplete, even at 350°, and, owing to the action of hydrated barium metaborate on barium carbonate at more elevated temperatures, there is no certainty that the residue will have a definite composition. From this it follows that the process originally proposed by Morse and Burton (Abstr., 1888, 755) cannot be recommended for the estimation of boric acid.

L. DE K.

**Analysis of Lithopone.** By CH. COFFIGNIER (*Bull. Soc. Chim.*, 1902, [iii], 27, 829—832).—The author shows that lithopone, which consists chiefly of zinc sulphide, zinc oxide, and barium sulphate, also often contains soluble zinc salts which have no value as paints. In determining the commercial value of lithopone, therefore, it is necessary to estimate the amount of zinc oxide and of the total amount of zinc in a sample after extracting with warm water.

A. F.

**Micrometric Assay of Gold Minerals.** By GUERREAU (*Bull. Soc. Chim.*, 1902, [iii], 27, 790—792).—In some cases of gold assay, the amount of gold obtained is so small as to be scarcely appreciable on the balance. In such cases, it has been proposed to measure the diameter of the gold grain, rendered spherical by fusion in a boric acid bead, by means of a microscope and micrometer eye-piece, and calculate from this the weight of the gold. The author's experiments confirm the accuracy of the method.

A. F.

**Estimation of Albuminoid and Proteid Ammonia.** By LUDWIG W. WINKLER (*Zeit. anal. Chem.*, 1902, 41, 290—300).—The following process is proposed as an improvement on that of Wanklyn for the estimation of the nitrogenous organic impurities in natural waters. To 100 c.c. of the water there are added 5 c.c. of  $N/5$  sul-



phuric acid (or sufficient to produce an acid reaction), and 5 c.c. of a 1 per cent. solution of purified potassium persulphate. The flask is immersed in the steam from a water-bath for 15 minutes, and then thoroughly cooled. The contents are then transferred to a cylinder, and 5 c.c. of the author's modified Nessler reagent containing alkali tartrate (Abstr., 1899, ii, 805) are added drop by drop. For purposes of comparison, 100 c.c. of the same water are treated in the cold with the same quantities of sulphuric acid, modified Nessler reagent, and persulphate, and then sufficient of a standard ammonium chloride solution (1 c.c. = 0.1 mgm.  $\text{NH}_3$ ) to give the same intensity of colour as in the heated sample. This mode of procedure eliminates the correction for the ammonia in the water and reagents. Urea, uric and hippuric acids yield considerably more ammonia by this process than by distillation with alkaline permanganate, but caffeine, leucine, tyrosine, aspartic acid, gelatin, and albumin yield approximately the same amount by both processes. Special experiments with these compounds show that the results are independent of the dilution. It is suggested that the designation "proteid ammonia" should be reserved for that estimated by oxidation with persulphate.

M. J. S.

**Detection of the Principal Impurities of Anthracene.** By THEODOR H. BEHRENS (*Rec. trav. chim.*, 1902, 21, 252—253. Compare Abstr., 1901, ii, 351).—The presence of carbazole is detected by making a cold extract of the anthracene with ethyl acetate, allowing the solution to evaporate, redissolving the residue in a few drops of the same solvent, and evaporating on a watch-glass; the carbazole accumulates at the edge of the deposit, and on mixing a small portion with a drop of nitrobenzene containing a few crystals of phenanthraquinone, copper-coloured plates are formed, even when only 0.5 per cent. of this impurity is present. For the detection of phenanthrene, the anthracene is extracted with benzene, the reagent being  $\alpha$ -dinitrophenanthraquinone dissolved in nitrobenzene. In this case, mixed crystals are obtained having the form and colour of the brown needles of the phenanthrene compound but containing a large quantity of anthracene.

A. F.

**Estimation of Chloroform Vapour in Air.** By AUGUSTUS D. WALLER (*Proc. Physiol. Soc.*, 1902; *J. Physiol.*, 28, xxxv—xxxvi).—A bottle filled with the mixture of air and chloroform vapour is connected with a water manometer and with a small pipette by which 5 c.c. of olive oil can be discharged into the bottle. This rapidly absorbs the vapour, and at the end of two minutes the percentage of chloroform is directly read on the manometer, which is empirically graduated. In some experiments, the water in the manometer was replaced with paraffin oil. The numbers obtained show that the results are remarkably accurate.

W. D. H.

**Soltzien's Method for the Estimation of Sugar.** By K. SCHUMANN (*Chem. Zeit.*, 1902, 26, 605).—The author having tried Soltzien's process (Abstr., 1901, ii, 286), states that the results are in excess of the truth. Cuprous oxide may be completely converted into copper oxide by ignition with or without the aid of nitric acid; sulphuric acid should not be added.

L. DE K.

**Detection of Wood-fibre.** By J. HERTKORN (*Chem. Zeit.*, 1902, 26, 632).—Amylsulphuric acid (this vol., ii, 434) is not the only colour test for wood-fibre, as the other alkyl compounds, and particularly the aromatic sulphonic acids, possess this power in a high degree. Ethylsulphuric and benzenesulphonic acids containing a little free sulphuric acid give blue, bluish-green, green, and greenish-yellow colorations on wood-fibre, according to the excess of free acid or the dilution. Naphthalenesulphonic acids cause a deep indigo-blue tinge, whilst the anthracenesulphonic acids and their oxidation products yield deep red colours which, if the liquid is diluted or somewhat neutralised, are orange or yellow. If aromatic hydrocarbons are heated with strong sulphuric acid until sulphur dioxide is given off, the reagent gives the most intense red or blue colours with wood-fibre, but, at the same time, the cellular fibre (Zellstoff) is also somewhat affected.

L. DE K.

**Estimation of Colophony in the Presence of Fatty Acids.** By D. HOLDE (*Zeit. angew. Chem.*, 1902, 15, 650—657).—A combination of the methods of Twitchell and Gladding. The fat or soap is fully saponified with alcoholic potassium hydroxide. The resulting soap freed from alcohol is, if necessary, separated from unsaponifiable matter by extraction with benzene, and then decomposed by means of hydrochloric acid. The fatty and resinous acids are removed from the liquid by repeatedly agitating it with ether, and this is then evaporated. The residue is now dissolved in absolute alcohol and treated with a current of hydrogen chloride; the product is boiled with water and dissolved in ether. The aqueous layer is neutralised and evaporated, when it is again acidified and repeatedly extracted with ether. The united ethereal solutions are shaken with aqueous potassium hydroxide containing 10 per cent. of alcohol, and the ether is then alternately shaken with water and alkali. The resin is now isolated from the mixed alkaline solutions by acidifying with hydrochloric acid and agitating with ether, which, on evaporation, leaves the resin in a fairly pure state. Traces of adhering fatty acids are now removed by Gladding's silver method. Colophony may be assumed to contain 8 per cent. of unsaponifiable matter, so a correction should be applied when calculating the percentage of resin. The process may also be used for the estimation of resin in the alcoholic extract of ceresin or paraffin.

L. DE K.

**Osmotic Analysis of Urine.** By ANTON STEYRER (*Beitr. chem., Physiol. Path.*, 1902, 2, 312—335).—Numerous analyses of the urine are given under normal conditions, and under the influence of certain drugs and of certain diseases. The main object of the paper is to insist on the importance of 'osmotic analysis' for diagnostic purposes. Among the pathological conditions described are three cases in which one ureter was compressed by new growths. In all three cases there was a great decrease of the molecular concentration of the urine.

W. D. H.

**Jolles' Method of Estimating Uric Acid in Urine.** By E. RICHTER (*Zeit. anal. Chem.*, 1902, 41, 350—359).—Of the three

methods in use for estimating uric acid in urine, namely, those of Ludwig-Salkowski, Hopkins-Folin, and Jolles (*Abstr.*, 1900, ii, 450), the first gives results about 2 per cent. too low, and the second fails with many pathological urines, and especially with those which contain crystalline deposits of uric acid.

The author confirms the accuracy of Jolles' method by numerous test analyses of pure uric acid, and draws attention to the special precautions necessary for obtaining correct results. The chief of these are (1) that towards the end of the oxidation the permanganate solution should not be added in larger quantities than 6—8 drops at once, although time may be saved if, when the yellow colour produced by that quantity does not disappear in five minutes, the mixture is made up to 500 c.c. and boiled for an hour, 2 c.c. more of permanganate being added during that time; (2) whilst neutralising with soda, the mixture must be thoroughly cooled, especially towards the close; (3) the alkaline mixture must be transferred to the azotometer and analysed immediately, otherwise traces of ammonia will be lost and the accuracy of the result impaired.

M. J. S.

**Estimation of Carbohydrates in Normal Urine by the Schotten-Baumann Method of Benzoylation.** By B. REINOLD (*Pflüger's Archiv*, 1902, 91, 35—70).—The amount of benzoate obtained from normal urine by the Schotten-Baumann method varies greatly with the conditions of the experiment, more especially with the amount of benzoyl chloride used, the amount of sodium hydroxide present, and the previous treatment of the urine with soda or basic lead acetate. The author has been unable to devise any modification of the method by which the same percentage of the total carbohydrate is precipitated from different urines. This process, therefore, when applied to normal urines, does not yield quantitative or even strictly comparable results.

A. H.

**Separation of Ternary Compounds and Bases from Animal or Vegetable Liquids.** By S. DOMBROWSKI (*Compt. rend.*, 1902, 135, 182—184). **Nitrogenous Compounds and Alkaloids of Normal Urine.** By S. DOMBROWSKI (*ibid.*, 244—246).—The experiments were made on urine. Normal lead acetate is added, and various nitrogenous substances are separated from the filtrate by the use of normal mercury acetate. By the use of the method, it is claimed that, among other substances, various alkaloids and mannitol can be separated from normal urine.

W. D. H.

**Blumenthal's Method of Estimating Hippuric Acid.** By FRANZ SOETBEER (*Zeit. physiol. Chem.*, 1902, 35, 536—539).—An examination was made of this method (*Zeit. klin. Med.*, 40, Heft. 3 and 4), and the conclusion drawn that it is untrustworthy. Lewin's results (*ibid.*, 42, Heft. 4 and 5), in which this method was employed, are therefore useless.

W. D. H.

**Estimation of Guanidine.** By A. VOZÁRIK (*Zeit. angew. Chem.*, 1902, 15, 670—672).—Eight grams of the guanidine salt are dissolved

in water and a little ammonia and the solution is diluted to 1 litre. When clear, 25 c.c. are mixed with 100 c.c. of ammonium picrate solution prepared by dissolving 8 grams of ammonium picrate, 0.075 gram of guanidine picrate, and 5 c.c. of ammonia (sp. gr. 0.91) in a litre of water. After 6—12 hours, the precipitate is collected on a Gooch asbestos filter and washed with picrate solution; after removing the adhering liquid as much as possible by suction, the crucible and contents are dried at  $110^{\circ}$  and weighed. The precipitate retains 1 and the asbestos layer 2.4—2.6 per cent. of its weight of ammonium picrate, for which allowance must be made; 1 mol. of the picrate is equivalent to 1 mol. of guanidine.

L. DE K.

**Microchemical Detection of Alkylamines.** By THEODOR H. BEHRENS (*Zeit. anal. Chem.*, 1902, 41, 269—279).—I. *Diamines: Separation from Monoamines.*—This is readily effected by shaking with benzoyl chloride and excess of sodium hydroxide, thus converting the alkylenediamines into their dibenzoyl derivatives, which are sparingly soluble in hot water. The product is warmed with water to remove monoamines and ammonia, then dissolved in a little alcohol. Water is added to incipient turbidity, which is removed by warming, and the solution then allowed to crystallise under the microscope. The diamines may also be liberated from their benzoyl derivatives by heating with dilute hydrochloric acid at  $160$ — $170^{\circ}$  in a sealed tube and distilling with sodium hydroxide. They can then be converted into platinichlorides. This course is the more advisable when trimethylenediamine occurs mixed with tetra- and penta-methylenediamines.

II. *Monoamines. A. Group Separations.*—By distillation with aqueous sodium hydroxide, the primary, secondary, and tertiary amines are separated from the non-volatile tetra-alkyl bases. The residue (1) is acidified with hydrochloric acid, dried, and extracted with chloroform or isobutyl alcohol, in which the chlorides of the quaternary bases are soluble. The distillate (2) is shaken with benzenesulphonic chloride (*Abstr.*, 1892, 64) and excess of sodium hydroxide. The primary amines (including ammonia) are converted into the corresponding benzenesulphonamides, which are soluble in sodium hydroxide, the secondary amines yield insoluble derivatives, and the tertiary are not affected. The reaction is complete in five minutes. The mixture is warmed to decompose excess of benzenesulphonic chloride, then cooled, and left to subside.

(3). After subsidence, the alkaline solution is removed and acidified, and the precipitate obtained is shaken with benzene, which dissolves the derivatives of the primary amines and of ammonia, leaving the tertiary amines in the acid solution (4).

(5). The sediment from (2) containing the secondary amines is washed and extracted with benzene or chloroform.

(6). The benzene solutions (3) and (5) are evaporated in small glass tubes, fuming hydrochloric acid is added, and the sealed tubes are heated for 10 minutes at  $160^{\circ}$ .

B. *Detection of the Individual Bases.*—The saponified product of A 3 is warmed to expel the acid, neutralised with sodium carbonate, and one-third of it distilled with sodium hydroxide. The distillate is added



to the other two-thirds and the whole again distilled. Ammonia is thus removed. Excess of soda is then added and the amines are distilled over. They are then converted into dinitro- $\alpha$ -naphthoxides, which are easily distinguished by their crystalline forms, or may be partially separated by treatment with oil of turpentine. The secondary amines (A 5) are similarly distilled and converted into dinitronaphthoxides.

The tertiary amines (A 4) are converted into platinichlorides or ferrocyanides, which are examined by the polariscope.

The chlorides of the quaternary bases (A 1) are also converted into platinichlorides or ferrocyanides, but in the case of mixtures the latter give confused crystals.

The microscopic characters of the various crystals, as also those obtained with magnesium acetate and sodium phosphate, uranyl acetate, platinic iodide, platinous chloride, palladium dichloride, and chloroanil, are described in the paper.

M. J. S.

**Estimation of Acid-Albumin in Digestive Mixtures.** By P. B. HAWK and WILLIAM J. GIES (*Amer. J. Physiol.*, 1902, 7, 460—491).—By careful neutralisation, almost all the acid-albumin formed during digestion can be precipitated. Some of the residual portion may be obtained by boiling, but the larger portion remains permanently in solution, apparently because of its hydration into non-coagulable forms. The presence of proteoses and peptone makes no difference.

W. D. H.

**The Use of Serum Precipitants for the Detection of Blood Spots in Forensic Medicine.** By JULES OGIER and HERSCHER (*Ann. Chim. anal.*, 1902, 7, 241—245).—The blood spot is dissolved in water and 2 or 3 c.c. of the solution are put into a test-tube 10—12 cm. long and 4—5 mm. diameter. A number of similar tubes are filled with solutions of blood of apparently the same strength and of various origin, such as blood of human beings, oxen, pigs, sheep, dogs, &c.

After adding to each 10 drops of the serum reagent, the tubes are immersed in water at 37—40°, and in the case of human blood a bulky precipitate will form after about 10 minutes and be fully deposited after half-an-hour. No notice should be taken of any small precipitate forming after that time, as other kinds of blood also gradually precipitate. Old blood spots if they have become insoluble, may also be recognised by this means.

The serum reagent consists of the serum of the blood of rabbits which have been repeatedly subcutaneously injected with the serum of human blood. At a temperature of -5° it may be kept active for about four months.

L. DE K.

**Qualitative Reactions of Reducing and Oxidising Diastases.** By M. EMM. POZZI-ESCOT (*Ann. Chim. anal.*, 1902, 7, 260—262).—When the living tissue of vegetable or animal origin decomposes hydrogen peroxide but does not affect a mixture of hydrogen peroxide with tincture of guaiacum, reductases may be suspected. In this case, they are treated out of contact with the air with solutions of indigo, litmus, or ferric ferri cyanide and any reducing action observed. They

also cause an evolution of hydrogen sulphide when mixed out of contact with air with sulphur and potassium fluoride.

Oxydases may be recognised by the blue colour produced on adding them to an emulsion of water and tincture of guaiacum and exposing to the air. They also reoxidise phenolphthalin to phenolphthalein so easily recognised by alkalis. Greiss' reagent and *m*-phenylenediamine should not be employed.

L. DE K.

**Malt Analysis.** By ARTHUR R. LING (*J. Fed. Inst. Brewing*, 1902, 8, 441—454).—A number of estimations of the 'diastatic power' of malt were carried out in order to test the accuracy of Kjeldahl's 'law of proportionality.' It was found that the law does not hold either for green malt or for low-dried malt when their extract is allowed to act on a solution of starch at the ordinary temperature. The 'diastatic power' as usually estimated may be misleading, since in order to meet the requirements of the 'law of proportionality' only very dilute solutions of diastase should be employed.

The following method is recommended for the estimation of extract. The moisture is first estimated. Fifty grams of finely powdered malt are introduced into an Erlenmeyer flask, 400 c.c. of water at 72° are added, the mixture is kept at 65° for an hour, and occasionally shaken. The mash is then cooled and sufficient water added to make the total water present 500 grams. The whole is then mixed and filtered, and the sp. gr. of the filtrate is determined. The volume (*V*) occupied by the dissolved matter from 50 grams of malt can then be calculated by means of the formula  $V = \frac{100S(500 + W)}{15.9(D - 10S)}$ , in which *S* is the number of grams of dissolved matter in 100 c.c. of wort, *W* the weight of water in 50 grams of malt, and *D* the sp. gr. of the wort (water = 1000).

E. G.

**[Choline as a Criterion for Artificial Brandy.]** By HEINRICH STRUYE (*Zeit. anal. Chem.*, 1902, 41, 284—289).—The author considers that the presence of choline may be employed as a criterion of an artificial brandy, as that substance is never found in genuine brandy, but exists in the flavouring ingredients which are added to commercial alcohol to simulate the natural spirit. The choline is detected by Florence's reaction (*Abstr.*, 1900, ii, 328). The aqueous residue obtained by distilling off the alcohol from 50 c.c. of the brandy is mixed with a few drops of dilute sulphuric acid, then with an excess of calcium hydroxide, and dried. The dry residue is extracted with 97 per cent. alcohol and the extract evaporated to dryness, then redissolved in a few drops of water and dried on a microscope slip. A drop of Florence's iodine solution is added and the preparation examined for the characteristic iodocholine crystals.

M. J. S.

## General and Physical Chemistry.

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**Effect of the Presence of Hydrogen on the Intensity of the Lines of the Carbon Spectrum.** By ARTHUR M. HERBERT (*Phil. Mag.*, 1902, [vi], 4, 202—207).—When an induction spark is passed through mixtures of carbon dioxide and hydrogen under atmospheric pressure, it is found that the intensity of the strong red line of the carbon spectrum rapidly diminishes with increasing percentage of hydrogen, far more rapidly than the strong violet line of the carbon spectrum under the same conditions. In a mixture with 5 per cent. of hydrogen, the red lines of the carbon and hydrogen spectra are about equally strong; in a mixture with 50 per cent. of hydrogen, the red carbon line is scarcely visible. The violet carbon line, on the other hand, is quite distinct in a mixture with 90 per cent. of hydrogen. Similar results are obtained when carbon monoxide or coal gas is substituted for carbon dioxide. When, on the other hand, the carbon compounds are diluted with air, the intensities of the two carbon lines diminish more or less equally. Special experiments show that the rapid extinction of the red carbon line in presence of hydrogen is not an apparent effect due to the glare of the neighbouring red hydrogen line. It is suggested that the red and violet lines belong to different carbon spectra, and that the molecular combination which gives rise to the red line is destroyed by hydrogen. J. C. P.

**Spectra of Potassium, Rubidium, and Cæsium, and their Mutual Relations.** By HUGH RAMAGE (*Proc. Roy. Soc.*, 1902, 70, 303—312. Compare this vol., ii, 545).—The oxyhydrogen flame spectra of these metals have been studied, and the lines observed, along with those already known, have been sorted into three series (a principal, and a first and second subordinate series). Diagrams, in which oscillation frequencies are taken as abscissæ, and either (1) the atomic masses, or (2) the squares of the atomic masses, as ordinates, have been drawn, and these show the close connection between the spectra and the atomic masses. Empirical formulæ are given by which the two subordinate series can be calculated with considerable accuracy, and the two limits in each spectrum towards which the two subordinate series converge have been determined. These formulæ show that the differences in the corresponding series depend wholly on the atomic masses of the elements. J. C. P.

**Deviabie Rays of Radioactive Substances.** By E. RUTHERFORD and A. G. GRIER (*Phil. Mag.*, 1902, [vi], 4, 315—330).—Uranium, thorium, and radium emit both deviable and non-deviable rays, the proportion of deviable rays being largest in the case of uranium; polonium, on the other hand, gives out no deviable rays. The active products separated from uranium and thorium contain all the substance responsible for the deviable rays, whilst the original radioactive material still retains the power of emitting, in the case of uranium a

large proportion, and in the case of thorium 30 per cent., of the non-deviable rays. The authors think that most of the deviable rays from uranium and thorium may be given out by a secondary product, derived by disintegration from the uranium or thorium molecule; the difference in properties between these secondary products (uranium X and thorium X) and the original substances renders their separation possible. The non-deviable rays may be due to the other secondary product, or to an inductive action of  $\text{UrX}$  or  $\text{ThX}$  on the mass of the radioactive material.

J. C. P.

**Amalgam Potentials, and the Question whether Metals Dissolved in Mercury are Monoatomic.** By FRITZ HABER (*Zeit. physikal. Chem.*, 1902, 41, 399—406).—Meyer's proof (Abstr., 1891, 984) that certain metals dissolve in mercury in the atomic form is regarded as invalid, since the metals may dissolve, not as such, but in the form of mercury compounds. If the compound formed be represented generally as  $\text{Hg}_m\text{M}_n$ , then Meyer has proved  $n=1$ , but assumed  $m=0$ . The author deduces a new expression for the *E.M.F.* of an amalgam concentration cell, based on the supposition that a compound  $\text{Hg}_m\text{M}_n$  is formed, which dissolves in excess of mercury. This expression is applicable in the two particular cases studied by Meyer (*loc. cit.*) and von Türlin (Abstr., 1890, 1046), and is analogous to the formula obtained by Dolezalek for the potential difference of two accumulators containing dilute sulphuric acid of different concentration.

J. C. P.

**The Potentials of Alloys and the Formation of Superficial Layers, being an Addition to the Paper on the Disintegration and Pulverisation of Cathodes.** By FRITZ HABER (*Zeit. Elektrochem.*, 1902, 8, 541—582).—In a former paper (this vol., ii, 441), it was shown that there are two kinds of alloys of sodium with lead or tin. Those containing small quantities of sodium evolve hydrogen slowly when placed in contact with water, and in a solution of lithium chloride in methyl alcohol at  $-80^\circ$  show the same potential as lead. Those containing more sodium are pulverised in contact with water and show a higher potential. It is now shown that the low potential of the less concentrated alloys is due to the formation of a superficial layer of lead (or tin) in contact with the cold liquid, the alloy then behaving as if it consisted of lead (or tin). In contact with a concentrated solution of sodium hydroxide at the ordinary temperature, this does not occur, the potential being much higher. Alloys of other metals which form compounds exhibit analogous phenomena: for example, the alloys of zinc and copper containing more copper than corresponds with the formula  $\text{Zn}_2\text{Cu}$  have the same potential as copper. Frozen sodium amalgam also behaves in this way, for a similar reason.

The potentials of the alloys rise in steps which appear to correspond with (a) pure lead, (b) a mixture of Pb and  $\text{PbNa}_x$  which decomposes water slowly, (c) a mixture of  $\text{PbNa}_x$  and  $\text{PbNa}_y$  (the latter compound exhibits the phenomenon of pulverisation) and (d) pure sodium. The values of  $x$  and  $y$  are not known. The tin alloys are quite similar to those of lead.

T. E.



**Transmission of Galvanic Polarisation through Platinum and Palladium Plates.** By WALTHER NERNST and A. LESSING (*Chem. Centr.*, 1902, ii, 240—241; from *Nachr. k. Ges. Wiss. Göttingen*, 1902, 146—159).—Root's experiments on the diffusion of hydrogen through platinum have been repeated and experiments have also been made with a small, sealed, platinum test-tube, the surface of which was platinised where it was in contact with dilute sulphuric acid. The potential difference between the inner surface and the liquid was first measured; the outer wall was then polarised and the potential inside and outside again determined. According to Zermelo, if the phenomenon is one of diffusion then the time required for the concentration (potential) of the hydrogen to attain a certain value on the other side of the plate is proportional to the square of the thickness of the plate. The results showed that in the case of hydrogen and oxygen the phenomenon is not due to diffusion but rather to the passage of electricity through pores contained in the platinum plates. It was found impossible, however, to obtain direct evidence of the presence of these pores. On the other hand, the passage of hydrogen through palladium follows Zermelo's law. Oxygen does not diffuse; the action of the oxygen liberated at the anode or of an oxidising agent depends on the destruction of the hydrogen potential on the other side of the plate. The diffusion phenomenon is independent of the source from which the hydrogen is obtained or of the method of its preparation. The concentration of hydrogen on one side of the plate is not affected by passing hydrogen through the liquid on the other or by adding a reducing agent such as potassium cobalticyanide. E. W. W.

**Electrical Conductivities of Solutions in Ethyl Bromide.** By WLADIMIR A. PLOTNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 466—472).—The author has made measurements, by the Kohlrausch-Ostwald method, of the electrical conductivities of various solutions of aluminium tribromide and of the compound  $\text{AlBr}_3 \cdot \text{EtBr} \cdot \text{Br}_2 \cdot \text{CS}_2$ ; the conductivities of these solutions are less than those of aqueous solutions of the normal salts. The molecular conductivity of the aluminium tribromide solution diminishes considerably as the dilution increases. With the complex compound, however, this change with dilution is but small.

Metallic aluminium is deposited on the cathode when aluminium bromide in ethyl bromide solution is subjected to electrolysis, but the complex compound referred to above cannot be electrolysed.

T. H. P.

**Galvanic Cells and the Phase Rule.** By W. REINDERS (*Proc. K. Akad. Wetensch. Amsterdam*, 1902, 5, 182—193).—The case mainly discussed by the author is that in which the electrolyte contains two different metallic salts,  $\text{M}_1\text{Z}$  and  $\text{M}_2\text{Z}$ , and the electrode may consist of one or both of the metals  $\text{M}_1$  and  $\text{M}_2$ . The possibility of the two metals forming a homogeneous liquid or solid solution or a compound is taken into account. The paper is a theoretical one and not suitable for abstraction. J. C. P.

**Asymmetry of the Electrocapillary Curve.** By JOHANNES JACOBUS VAN LAAR (*Zeit. physikal. Chem.*, 1902, **41**, 385—398. Compare Palmaer, Abstr., 1898, ii, 276; 1899, ii, 347; 1901, ii, 370; Smith, Abstr., 1900, ii, 330).—A theoretical discussion of the capillary electrometer. The electrocapillary curve consists of two distinct portions of a parabolic nature, which cut each other at zero potential. There is a maximum point on the ascending curve, but this maximum need not correspond with zero potential. It follows that Lippmann's capillary electrometer cannot be used for the direct determination of potential differences between metal and electrolyte. J. C. P.

**Electrolysis of Molten Salts.** By GUIDO BODLÄNDER (*Zeit. anorg. Chem.*, 1902, **32**, 235—238).—A reply to Lorenz (this vol., ii, 591) with reference to the work of Suchy (Abstr., 1901, ii, 369). The author has considered the cell studied by Suchy from a thermodynamic point of view and finds that this leads to a conclusion opposite to that experimentally found. J. McC.

**Electrolysis of Molten Salts.** By RICHARD LORENZ (*Zeit. anorg. Chem.*, 1902, **32**, 239—246).—Polemical—a reply to Bodländer (see preceding abstract). The author justifies the methods used by Suchy (Abstr., 1901, ii, 369) in obtaining his results. J. McC.

**Electrochemical Behaviour of Sulphur.** By FRIEDRICH WILHELM KÜSTER (*Zeit. Elektrochem.*, 1902, **8**, 496—499).—The author has observed that during the electrolysis of a solution of a polysulphide both the current and the voltage undergo periodic variations, which are shown to be due to the deposition of sulphur on the anode. The periodicity of the phenomenon is, however, difficult to understand. In order to throw light on this, a number of measurements of the potential differences between electrodes of platinum or of silver and solutions of sodium polysulphides are made. The results show that such electrodes may be regarded as sulphur electrodes, just as a platinum plate saturated with oxygen may be regarded as an oxygen electrode. T. E.

**Laws of Electrolysis of the Vapours of Alkali Salt.** By HAROLD A. WILSON (*Phil. Mag.*, 1902, [vi], **4**, 207—214. Compare Abstr., 1899, ii, 722; 1901, ii, 490).—When a salt solution is sprayed, and the vapour of the salt is caused to pass between two electrodes at 1350°, the quantity of vapour and the amount of electricity transported by it are proportional. Further, when a definite amount of any salt passes between the electrodes, the saturation current is inversely proportional to the chemical equivalent of the salt, and the factor of proportionality is the same as in the case of aqueous electrolytes. These results demonstrate the complete analogy between vapours of salt and electrolytes, so far as the passage of a current is concerned.

J. C. P.

**Electrolysis of Alkali Chlorides with Platinised Electrodes.** By FRITZ FOERSTER and ERICH MÜLLER (*Zeit. Elektrochem.*, 1902, **8**, 515—540).—The authors confirm the observation made by Lorenz and

Wehrlin (Abstr., 1900, ii, 476) that the *E.M.F.* required to electrolyse a solution of sodium chloride with a platinised anode is approximately 0.5 volt less than that required with a smooth platinum anode, but show that the only difference in the chemical behaviour of such anodes is that at the platinised anode oxygen and chlorate begin to be formed somewhat later and at a higher concentration of the hypochlorite than is the case at a smooth anode; thereafter the two behave similarly.

Chemical experiments show that platinum black decomposes hypochlorous acid into oxygen, and hydrochloric and chloric acids, but that the velocity of the change is far too small to explain the formation of these substances at the anode during electrolysis.

The *P.D.* between a platinised platinum cathode and a concentrated solution of sodium chloride containing a little chromate is constant, for since hypochlorites are not reduced appreciably at such a cathode, it behaves like a normal hydrogen electrode. With a cathode of this kind and a platinised anode, the *E.M.F.* required to electrolyse a solution of sodium chloride is very little greater than that theoretically needed,  $2.23 + cr$ , where 2.23 is the *E.M.F.* needed to decompose sodium chloride,  $c$  the current, and  $r$  the resistance of the solution. With a smooth anode, the *E.M.F.* is higher by a quantity which increases with the duration of the electrolysis to as much as 0.8 to 0.9 volt. A similar difference is found in all cases in which oxygen is evolved at the anode: for example, in the electrolysis of sulphuric acid or sodium hydroxide.

These large differences cannot be explained by differences in the concentration of the solution in contact with the anode. An alkaline solution of potassium iodide (from which no oxygen is evolved during electrolysis) gave a difference of at most 0.07 volt between smooth and platinised anodes.

The authors suggest that the difference may be due to the greater polarisation capacity of the platinised anode, owing to which the concentration of the occluded oxygen in it would be very much smaller than in a smooth anode.

T. E.

**Electromotive Behaviour of Hypochlorous and Chloric Acids.** By ROBERT LUTHER (*Zeit. Elektrochem.*, 1902, 8, 601—604).—The *P.D.* between an indifferent electrode and a solution containing hypochlorous and hydrochloric acids and chlorine may be conditioned by any one of the following equilibria ( $F$  stands for an electric charge),  $2Cl' + 2F \rightleftharpoons Cl_2$ ;  $Cl_2 + 2H_2O + 2F \rightleftharpoons 2HClO + 2H'$ ;  $2Cl' + H_2O + 4F \rightleftharpoons 2HClO + 2H'$ .

In a solution containing hydrochloric and hypochlorous acids and chlorine in equilibrium with each other, the ratio  $Cl_2/H' \times Cl' \times HClO =$  a constant (Jakowkin, Abstr., 1899, ii, 736), and in such a solution each of the above equilibria would give the same *P.D.* The *P.D.* corresponding with the first is known from the *E.M.F.* of the chlorine-hydrogen cell. The author shows that from these data it is possible to calculate the *P.D.* corresponding with the remaining two equilibria in solutions containing varying quantities of hydrochloric and hypochlorous acids and chlorine. Applying these calculations to Müller's measurements (this vol., ii, 591), he shows that the second equation leads to

impossible or highly improbable concentrations of chlorine in the solutions, whilst the third equilibrium gives concentrations of hydrochloric acid which are approximately proportional to the concentration of the hypochlorous acid used. It is therefore probable that the *P.D.* of a platinum electrode immersed in a solution of hypochlorous acid is conditioned by the equilibrium  $2\text{Cl}' + \text{H}_2\text{O} + 4\text{F}' \rightleftharpoons 2\text{HClO} + 2\text{H}'$ . T. E.

**The Behaviour of Hypochlorous Acid and its Salts during Electrolysis.** By FRITZ FOERSTER and ERICH MÜLLER (*Zeit. Elektrochem.*, 1902, 8, 633—638 and 665—672).—Measurements of the discharge potential show that, in solutions of equal concentration,  $\text{ClO}$  ions are discharged at a somewhat higher potential than  $\text{OH}$  ions, the discharge potential of  $\text{Cl}$  ions in neutral solution being still higher. When a solution of hypochlorous acid, acidified with phosphoric acid, is electrolysed, oxygen and chlorine are evolved at the anode and chloric acid formed there. This is most simply explained by assuming that  $\text{ClO}$  ions are discharged and then react with water as follows,  $6\text{ClO} + 3\text{H}_2\text{O} = 2\text{HClO}_3 + 4\text{HCl} + 3\text{O}$ . The  $\text{Cl}$  ions thus formed are discharged at once, giving chlorine gas. The quantities of the products found are in good agreement with this view. In neutral or alkaline solutions of hypochlorites, the same reaction appears to take place; chlorine is not evolved as gas, however, but is found in the solution as chloride, which takes part in the further electrolysis.

T. E.

**Cuprous Compounds.** By GUIDO BODLÄNDER (*Zeit. Elektrochem.*, 1902, 8, 514—515).—The cuprous ion has the formula  $\text{Cu}'$ , not  $\text{Cu}_2''$ . The electrolytic potential (Abstr., 1901, ii, 2) of cuprous copper is  $-0.454$  volt. The solubility products of the cuprous halogen salts are,  $1.2 \times 10^{-6}$  for  $\text{CuCl}$ ,  $4.15 \times 10^{-8}$  for  $\text{CuBr}$ , and  $5.06 \times 10^{-12}$  for  $\text{CuI}$ . The tendency to form complex ions such as  $\text{CuCl}_2'$  is measured by the equilibrium constant  $k = (\text{CuCl}_2')/(\text{Cu}')(\text{Cl}')^2$ . The value of  $k$ , is  $3.95 \times 10^4$  for the ion  $\text{CuCl}_2'$ ,  $1.1 \times 10^5$  for  $\text{CuBr}_2'$ , and  $1.55 \times 10^8$  for  $\text{CuI}_2'$ . The solubility product therefore decreases and the tendency to form a complex ion increases as the discharge potential of the halogen diminishes. This is in accord with the author's theory (Abstr., 1899, ii, 542).

T. E.

**Electrolytic Phenomena at the Common Surface of Two Solvents.** By WILHELM HITTORF (*Ann. Physik.*, 1902, [iv], 9, 243—245. Compare this vol., ii, 58).—The author does not agree with the interpretation of his previous results (*loc. cit.*) given by Nernst and Riesenfeld (*Ann. Physik.*, 1902, 8, 600). It is shown that the transport numbers obtained from a weak gelatin solution of cadmium chloride have the same values as those obtained from an ordinary aqueous solution.

J. C. P.

**Electro-affinity as a Basis for the Systematisation of Inorganic Compounds.** By RICHARD ABEGG and GUIDO BODLÄNDER (*Amer. Chem. J.*, 1902, 28, 220—228).—A reply to the criticisms of Locke (this vol., ii, 240).

E. G.



**Dissociation of Dibasic Acids.** By RUDOLF WEGSCHEIDER (*Monatsh.*, 1902, 23, 599—668. Compare Noyes, *Abstr.*, 1893, ii, 365, and Smith, *Abstr.*, 1898, ii, 155, 284).—The dissociation constant for the second hydrogen atom of dibasic acids, which has been previously calculated from observations made with the acid salt, may be calculated from the molecular conductivity of those acids which show dibasic dissociation at moderate dilutions.

If  $g_1$  represents the univalent ions and  $g_2$  the bivalent ions, present when 1 gram-mol. is dissolved in the volume  $v$ , then (1)  $K = \frac{g_1(g_1 + 2g_2)}{(1 - g_1 - g_2)v}$  and (2)  $s = \frac{g_2(g_1 + 2g_2)}{g_1v}$ , where  $K$  represents the dissociation constant for the first hydrogen atom and  $s$  that for the second. The equations by which the velocity of the ion is calculated,  $\lambda\infty = l_K + l_A$  and  $\frac{n}{1-n} = \frac{l_K}{l_A}$ , are equally available for univalent or for polyvalent ions. In the case of symmetrical dibasic ions, the molecular conductivity is expressed as a function of the concentration and the velocity of the ions, hence (3)  $\mu = g_1\mu\infty + 2g_2(l_K + l_{2A})$ . The velocity of carboxylic ions depends chiefly on the number of atoms in the ion. Of two ions containing an equal number of atoms, that with the greater valency has the greater velocity. The difference in velocity is not proportional to the difference in valency. The value of  $g_2$  is calculated from equations (1) and (3);  $g_2 = \frac{\mu^2 - kv\mu\infty(\mu\infty - \mu)}{[2(l_K + l_{2A}) - \mu\infty](2\mu + kv\mu\infty)}$  and hence  $g_1 = \frac{\mu - 2g_2(l_K + l_{2A})}{\mu\infty}$ .

In the case of unsymmetrical dibasic acids, the dissociation of the first hydrogen atom results in a mixture of two acid ions,  $g_1' + g_1'' = g_1$ , and gives therefore two dissociation constants,  $k' + k'' = k$ ; hence there

Acid.	$10^6 \times s.$	Acid.	$10^6 \times s.$
Diglycollic acid .....	37	$\beta$ -Bromoethylsuccinic acid.....	64
Thiodiglycollic acid .....	33	$\alpha$ -Bromoethylsuccinic „ .....	36
Dithiodiglycollic „ .....	52	Maleic „ .....	8 ?
Thiodiacetic „ .....	475	Fumaric „ .....	29
$\alpha$ -Thiodipropionic acid.....	364	Mesaconic „ .....	9
$\alpha$ -Thiopropionacetic „ .....	452	$\alpha$ -Hydroxycamphoronic acid .....	13
Suberic „ .....	3.3 ?	$\alpha$ -Hydroxyisocinchomeronic acid.	2
Azelaic „ .....	4.3	Papaveric „ .....	70
Malonic „ .....	10 ?	3-Nitrophthalic „ .....	40
Benzylidenemalonic „ .....	3.2	4-Nitrophthalic „ .....	40
Dibenzylmalonic „ .....	19	3 : 6-Dichlorophthalic „ .....	280
Chloromalonic „ .....	194	Uvitic „ .....	53 ?
Malic (active) „ .....	7.5	Hydroxyterephthalic „ .....	45
Malic (inactive) „ .....	5.5	Bromoterephthalic „ .....	76
<i>d</i> -Tartaric „ .....	45	Nitroterephthalic „ .....	200
<i>l</i> -Tartaric „ .....	42	$\beta$ -Hydroxycamphoronic „ .....	21
Racemic „ .....	40	Aconitic „ .....	35
Chlorosuccinic „ .....	36	Butenyltricarboxylic „ .....	22
Bromosuccinic „ .....	39	1 : 1 : 2-Trimethylenetricarboxylic	
Bromopyruvic „ .....	51	acid .....	41

are two constants,  $s'$  and  $s''$ , for the second stage of the dissociation, which stand to the constant determined in the relation  $s' = 1 + b/b's$  and  $s'' = (1 + b)s$ , where  $b = k'/k''$ .

The values given on the preceding page have been calculated from previously published conductivity experiments, partly of other authors.

The author compares his values for  $s$  with those obtained by Smith (*loc. cit.*), points out some probable sources of error, and concludes that the influence of constitution on the dissociation constant of the second hydrogen atom is not so simple as suggested by Noyes (*loc. cit.*) and Smith.  
G. Y.

**Boiling Point Curve of the System—Hydrazine + Water.** By CORNELIS A. LOBRY DE BRUYN and J. W. DITO (*Proc. K. Akad. Wetensch. Amsterdam*, 1902, 5, 171—174).—The boiling points of hydrazine-water mixtures of different composition have been determined, as well as the composition of the vapour given off by the boiling liquid in each case. The boiling point curve shows a maximum at the temperature  $120.5^\circ$  (pressure 771 mm.) for a mixture containing 58.5  $\text{N}_2\text{H}_4$  to 41.5  $\text{H}_2\text{O}$ .  
J. C. P.

**Studies in Vapour Composition. II.** By HECTOR R. CARVETH (*J. Physical Chem.*, 1902, 6, 321—338).—A continuation of the author's previous paper (this vol., ii, 600). A simple form of apparatus for heating a system by vapour is described. The author extends his previous discussion to three component and multicomponent systems.  
L. M. J.

**Numerical Studies on The Equation of Fluids. An Expansion Formula for Liquids.** By EDOUARD MALLET and L. FRIDERICH (*Arch. Sci. phys. nat.*, 1902, 14, 50—58).—The formula  $v = c - d \log(t_c - t)$  was proposed by Avenarius for the expansion of liquids,  $t_c$  being the critical temperature. The authors find that if  $t_c$  be replaced by a constant  $A$ , in general a few degrees above the critical temperature, the formula gives results in good accord with the experimental data for temperatures up to  $30^\circ$  or  $40^\circ$  below the critical. The formula permits of the ready calculation of the coefficient of expansion at any temperature and it is found that the ratio of  $c$  to  $d$  is almost constant, only varying, in the 25 compounds considered, between 3.66 and 3.90 with a mean of 3.78.  
L. M. J.

**Physical Purity of Liquids.** By F. V. DWELSHAUVERS-DERY (*Bull. Acad. roy. Belg.*, 1902, 347—349. Compare Traube, this vol., ii, 557).—A chemically pure liquid consists of (a) liquidogenic molecules, (b) gasogenic molecules, (c) molecules of dissolved extraneous gases, especially air, the relative proportions of these constituents depending on the temperature of the liquid. The realisation of a physically pure liquid, that is, one consisting of liquidogenic molecules, only, could not take place, as Traube has suggested (*loc. cit.*), at absolute zero, since solidification would occur and it is doubtful whether this condition was secured by Donny (*Mem. Acad. roy. Belg.*,

1845, 15) who eliminated extraneous gases from water by slow ebullition in a vacuum. T. A. H.

**Formation of Hydrates in Aqueous Solutions.** By OTTO SCHMATOLLA (*Chem. Centr.*, 1902, ii, 495; from *Apoth.-Zeit.*, 17, 490—491).—The change of volume which occurs when alcohol and water are mixed has been measured by adding small quantities of water (3—10 c.c.) to a litre of absolute alcohol, and determining the density of the mixture after each addition. The result showed that up to 25 per cent. alcohol there is a contraction, but on further dilution the volume gradually increases. The curve obtained from the experimental data shows numerous breaks in continuity, especially between 100 and 70 per cent. alcohol, these points corresponding with hydrates containing  $1/16$ ,  $1/8$ ,  $1/3$ , and  $1H_2O$ . The transition from contraction to expansion of volume, however, shows no break in continuity of the curve.

When alcohol is diluted with water, two processes take place, (1) the incorporation of the freshly added solvent, and (2) the gradual coalescence of both the lowest compounds of the dissolved substance with the solvent to form more complex compounds. E. W. W.

**Solubility of Sulphur Dioxide in Aqueous Salt Solutions and its Interaction with the Salts.** By CHARLES J. J. FOX (*Zeit. physikal. Chem.*, 1902, 41, 458—482).—In some cases, sulphur dioxide is more soluble in salt solutions than in pure water, in other cases less soluble, the alteration of solubility being nearly proportional to the salt concentration. The solubility increases from sulphate to iodide in the series—sulphate, nitrate, chloride, bromide, thiocyanate, and iodide, and from cadmium to ammonium in the series—cadmium, sodium, potassium, and ammonium. The determination of the temperature coefficient of the solubility shows that all the salts except the sulphates form complexes containing  $SO_2$ , apparently of the type  $MX, SO_2$  (compare Péchard, *Abstr.*, 1900, ii, 398). These conclusions are borne out by the relative conductivities of the salt solutions with and without sulphur dioxide. The conductivity in the case of salts which react with sulphur dioxide is much reduced, owing doubtless to the formation of complex anions with low mobility. Potassium iodide, bromide, chloride, and thiocyanate absorb sulphur dioxide at the ordinary temperature and pressure to form the compounds  $KX, SO_2$ . The compound  $KNO_3, SO_2$ , on the other hand, appears to have at the ordinary temperature a dissociation pressure greater than 760 mm., and cannot therefore be obtained under the same conditions as the other compounds. J. C. P.

**Double Salts in Solution.** By P. N. EVANS (*Chem. News*, 1902, 86, 4—5).—When to a saturated solution of an electrolyte, a second electrolyte is added having an ion in common with the first, separation of the first electrolyte in the solid form does not always take place; thus a solution of barium nitrate does not cause the separation of barium chloride from a saturated solution of the latter. Many instances of such a behaviour are given. It is thought that this

peculiarity is due to the formation of complex negative ions in solution, or, in other words, of double salts; the latter cannot be obtained in the solid form from these solutions, as the condition that the molecular solubility of the double salt should be less than that of either of the constituents is not fulfilled. The molecular solubility (solubility divided by molecular weight) of twelve double salts is given and compared with that of their constituents. K. J. P. O.

**Insoluble Inorganic Compounds in Colloidal Solution.** By CORNELIS A. LOBRY DE BRUYN (*Ber.*, 1902, 35, 3079—3082).—When certain insoluble substances, such as silver chromate, silver chloride, or sulphur, are formed in a gelatin or sugar solution, a clear solution is first obtained from which the precipitate only separates slowly. In the case of sulphur, the solution slowly develops a bluish- or brownish-red colour from a sugar solution; the different colours are attributed to a difference in the size of the sulphur particles. J. McC.

**Molecular Concentration of Solutions containing Albumin and Salts.** By LÉON FREDERICQ (*Bull. Acad. Roy. Belg.*, 1902, 437—444).—When a crystalloid is added to an aqueous solution of albumin, cryoscopic measurements show that the mixture behaves as if the molecules of the crystalloid were distributed in the volume of the water contained in the solution. The observations were made on aqueous solutions of egg-albumin; the crystalloids employed being sodium nitrate, sodium chloride, and carbamide. It is pointed out that the molecular concentration of solutions is expressed as gram-molecules per litre of solution (Arrhenius), or as gram-molecules added to 1000 grams of water (Raoult), which leads in the case of concentrated solutions to different values for their molecular concentration.

T. A. H.

**Rate of Coagulation of Colloidal Silicic Acid.** By WALTER FLEMING (*Zeit. physikal. Chem.*, 1902, 41, 427—457).—Colloidal silicic acid was obtained by mixing solutions of water glass and hydrochloric acid, and coagulation was regarded as complete when the containing vessel could be inverted, or when the mixture ceased to drop; for the latter method, an apparatus was devised to register the intervals of time between successive drops. The rate of coagulation increases with rising temperature and with increasing concentration of the silicic acid. Hydrogen and hydroxyl ions have a catalytic effect on the rate of coagulation; as the concentration of hydrogen ions increases, the coagulation is first retarded and then accelerated; as the concentration of hydroxyl ions increases, the coagulation is first accelerated and then retarded. J. C. P.

**Intramolecular Rearrangement in Halogen-acetanilides, and its Velocity.** By JAN J. BLANKSMA (*Proc. K. Akad. Wetensch. Amsterdam*, 1902, 5, 178—182. Compare this vol., i, 600; Chattaway and Orton, *Proc.*, 1902, 18, 200).—In presence of hydrochloric acid, acetylchloroanilide is gradually transformed into *p*-chloroacetanilide, and since only the former of the two compounds liberates iodine from potassium iodide, the course of the trans-



formation may be followed quantitatively. The reaction was carried out in 20 per cent. acetic acid solution at  $25^{\circ}$ , and the velocity constant was found to be that for a unimolecular reaction, whence it follows that the transformation consists in an intramolecular rearrangement of atoms (compare the case of the bromoamides studied by van Dam and Aberson, *Abstr.*, 1901, ii, 88). When double the quantity of hydrochloric acid is added, the velocity constant is nearly four times as great. With sulphuric acid, the conversion takes place very slowly, and the velocity coefficient is not so satisfactorily constant. In glacial acetic acid and alcoholic solutions, the reaction proceeds with increasing velocity owing to the production of a catalyser.

The reaction studied in this paper is much accelerated by light, and it appears to be a general rule that the radicles Br, Cl,  $\text{NO}_2$ , NO, and O attached to nitrogen, change places, under the influence of sunlight, with an H atom in the nucleus. J. C. P.

**Velocity of Decomposition of Bromosuccinic Acid in Aqueous Solution.** I. Course of the Reaction at  $50^{\circ}$ . By WOLF MÜLLER (*Zeit. physikal. Chem.*, 1902, 41, 483—497).—In aqueous solution, bromosuccinic acid decomposes into hydrogen bromide and either fumaric acid or a mixture of fumaric and malic acids, according to the concentration; the nature, however, of the organic acid produced in the decomposition has no effect on the reaction velocity. In presence of strong acids, the decomposition is retarded, and thus the decomposition is a case of autocatalysis, inasmuch as it is accompanied by an increase of acidity. The author makes the assumption that the reaction velocity is inversely proportional to the concentration of the hydrogen bromide at the time, as well as directly proportional to the concentration of the undecomposed bromosuccinic acid, and it is found that the equation based on this assumption satisfactorily represents the course of the reaction. When a large quantity of strong acid is added to begin with, so large that the increase of acidity during the reaction is relatively negligible, the reaction is unimolecular. The assumption referred to above is in accordance with Euler's theory (*Abstr.*, 1900, ii, 532). J. C. P.

**Inversion.** By CARL KULLGREN (*Zeit. physikal. Chem.*, 1902, 41, 407—426. Compare *Abstr.*, 1901, ii, 149, 496).—Attempts which have been made to determine the percentage hydrolysis of inorganic salts from the acceleration of sugar inversion induced by these have, in the majority of cases, given a doubtful result, because the inversion coefficient obtained at temperatures near  $100^{\circ}$  is not constant, but increases rapidly with the time. Even pure solutions of sugar are inverted on prolonged heating at  $100^{\circ}$  (compare Rayman and Sulč, *Abstr.*, 1897, ii, 136; Smith, *Abstr.*, 1898, ii, 155), and the inversion coefficient rapidly increases. This inversion of pure sugar solutions may be attributed to the hydrogen ions derived from the water itself, from the sucrose (compare Kullgren, *Abstr.*, 1901, ii, 496), and from the invert sugar (compare Cohen, *Abstr.*, 1900, ii, 716). The author proves, however, that only the first stage of the inversion can be quantitatively accounted for in this way; his own numerous experiments show that as the inversion coefficient increases, there is a

formation of acid (apparently from the invert sugar) in gradually increasing quantity, this quantity being nearly proportional to the amount of the invert sugar. On the basis of this observation, the equation  $dc/dt = k.x(A-x)$  is formulated, and it is found that this represents satisfactorily the latter and major part of the inversion process.

As might be expected, there is a similar formation of acid, leading, in most cases, to a rapid increase of the inversion coefficient, when salts are present. With certain highly hydrolysed salts, notably those of aluminium, the inversion coefficient is satisfactorily constant, because the rôle of the acid produced during inversion is insignificant as compared with that of the hydrolysed salt; and, more generally, the smaller the percentage of hydrolysis of the salt, the greater is the relative increase of the inversion coefficient.

J. C. P.

**Synthetic Analysis in Ternary Systems.** By A. W. BROWNE (*J. Physical Chem.*, 1902, 6, 287—312).—It has been shown that the composition of a solid phase separating from a solution may be determined by (1) comparison of the composition of the mother liquor with that of the original solution, and (2) by determining the composition of the solid which can be added to the system without disturbing the equilibrium. The method has been tested in a large number of cases in which the nature of the solid phase varies, and the following systems were investigated. (1) Potassium chloride, hydrogen chloride, and water; solid phase, a pure component, potassium chloride. (2) Sodium sulphate, sodium chloride, and water; solid phase,  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ , a binary compound of components. (3) Barium chloride, hydrogen chloride, and water; solid phase,  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ , a binary compound. (4) Ferric chloride, hydrogen chloride, and water; solid phase, hydrated ferric chloride. (5) Potassium sulphate, ammonium sulphate, and water; solid phase, a solid solution of ammonium and potassium sulphates. The graphic method of calculation by the aid of the equilateral diagram was also employed, and the conditions for accurate results are discussed.

L. M. J.

**Formation of Mixed Crystals by Sublimation.** By GIUSEPPE BRUNI and M. PADOA (*Atti R. Accad. Lincei*, 1902, [v], 11, i, 565—569).—The authors have succeeded in obtaining mixed crystals by sublimation, their method of working being as follows. The mixed substances were melted, and the mass afterwards powdered and introduced into a glass tube, which was sealed up after the pressure in it had been reduced to 12—14 mm. of mercury. The tube was then heated in a bath kept at a constant temperature below the melting point of the mixture.

From a mixture of azobenzene and stilbene, mixed crystals were obtained containing a much smaller proportion of stilbene than the original mixture. Mixed crystals were also prepared from mercuric bromide and iodide, the latter being present in smaller proportion than before sublimation.

The relation between the original and final concentrations of the components gives a measure of the distribution-coefficients of the sub-

stances between the heated, solid mixture and the mixed vapour in contact with it.

The crystals formed by sublimation of mercuric chloride and iodide together are mixed crystals, as was pointed out by Selmi in 1844, although the latest text-books state that they are compounds of the compositions  $\text{HgI}_2, \text{HgCl}_2$  and  $\text{HgI}_2, 2\text{HgCl}_2$ . T. H. P.

**Weights of Atoms.** By LORD KELVIN (*Phil. Mag.*, 1902, [vi], 4, 177—198).—A review of the theoretical and experimental work which has been done on the problem of absolute molecular dimensions, and questions connected therewith. The author himself estimates that the number of molecules present in 1 c.c. of a gas is not less than  $10^{20}$ , and is probably greater. On the basis of this value, the weight of one molecule of hydrogen is calculated to be  $0.9 \times 10^{-24}$  gram. J. C. P.

**Mathematical Expression of the Valency Law of the Periodic Table, and the Necessity for Assuming that the Elements of its First Three Groups are Polyvalent.** By GEOFFREY MARTIN (*Chem. News*, 1902, 86, 64—65).—By representing the valencies and the group numbers of the elements on a system of ordinates, the author arrives at the equation,  $v^2 - n^2 - 8(v - n) = 0$ , as giving the law of valency for elements of moderate atomic weight and at the normal temperature, where  $v$  represents the valency and  $n$  the group number. As a result, the elements of the first three groups should be polyvalent, that is, should act with several different degrees of valence towards other radicles. The polyvalent character of these elements is shown in their compounds with metals. K. J. P. O.

## Inorganic Chemistry.

**The Hydrates of Perchloric Acid.** By H. J. VAN WYK (*Zeit. anorg. Chem.*, 1902, 32, 115—120).—The melting point curve of all mixtures of perchloric acid and water has been determined. This has been found to consist of the melting point curves of five hydrates along with the ice curve and the curve for solid perchloric acid. The melting point of perchloric acid is  $-83^\circ$ ; that of  $\text{HClO}_4, \text{H}_2\text{O}$  is  $50^\circ$ ; that of  $\text{HClO}_4, 2\text{H}_2\text{O}$  is  $-20.6^\circ$ ; that of  $\text{HClO}_4, 3\text{H}_2\text{O}$  is  $-47^\circ$ ; that of  $\text{HClO}_4, 4\text{H}_2\text{O}$  is  $-40^\circ$ ; and that of  $\text{HClO}_4, 6\text{H}_2\text{O}$  is  $-45^\circ$ . There also exists a metastable hydrate which melts at  $-64^\circ$ . J. McC.

**The Behaviour of Bromine to High Pressure Electric Discharges.** By KARL KELLNER (*Zeit. Elektrochem.*, 1902, 8, 500—504).—Pure, dry and air-free bromine is enclosed in double-walled tubes, similar to ozone tubes, and submitted to an alternating current at 250,000 to 300,000 volts pressure, obtained by means of a Tesla transformer. After some hours, a sulphur-yellow, crystalline deposit appears on the walls of the tube, and when small quantities of bromine are used the whole may be transformed into the new substance. The author states that the glass itself takes no part in the change. T. E.

**Preparation of Periodates.** By FERDINAND ROQUES and AUGUSTE GERNGROSS (*J. Pharm. Chim.*, 1902, [vi], 16, 120—121).—Alkali

periodates are readily prepared by the action of an excess of a hypochlorite on an iodide in alkaline solution. Fifty grams of potassium iodide and 20 grams of sodium hydroxide are dissolved in water and a large excess of sodium hypochlorite is added. On heating the mixture on the water-bath, an abundant precipitate of crystalline sodium periodate is gradually deposited.

H. R. LE S.

**Liquid Air.** By ARSÈNE D'ARSONVAL (*Ann. Chim. Phys.*, 1902, [vii], 26, 433—460).—An historical summary of the methods devised to prepare liquid air, and an account of experiments carried out by the aid of this product.

G. T. M.

**Preparation of Ozone.** By CARL ARNOLD and CURT MENTZEL (*Ber.*, 1902, 35, 2902—2907).—See this vol., ii, 691.

**Ozonic Acid.** By ADOLF VON BAEYER and VICTOR VILLIGER (*Ber.*, 1902, 35, 3038—3039).—Solid potassium hydroxide is coloured an intense orange-brown by ozone (Wurtz, *Dict. Chim.*, p. 721). The colour is at once destroyed by the addition of water and a vigorous evolution of gas occurs. The coloured substance appears to have no oxidising properties and hydrogen peroxide could not be detected in the aqueous solution. A similar coloration is produced when ozonised oxygen is passed into 40 per cent. aqueous potash cooled by a freezing mixture, but the colour disappears when the solution is removed from the freezing mixture. Rubidium hydroxide behaves in a similar manner, whilst sodium hydroxide is only coloured a faint yellow. It appears probable that the potassium compound is potassium tetra-oxide, and in this case it may be regarded as the salt of an ozonic acid,  $O_3 + H_2O = H_2O_4$ .

A. H.

**Amorphous Sulphur.** By ALEXANDER SMITH and WILLIS B. HOLMES (*Ber.*, 1902, 35, 2992—2994).—The solidifying point of molten sulphur depends on the amount of amorphous sulphur, which the sample contains. Thus when 32 grams of amorphous sulphur are dissolved in 100 grams of molten crystalline sulphur, the solidifying point is depressed from  $119.25^\circ$  to  $42.5^\circ$ , a result which, after allowance has been made for the latent heat, would show that the molecule of amorphous sulphur is  $S_8$ . If crystalline sulphur is heated in a sealed tube at  $448^\circ$  for  $1\frac{1}{2}$  hours and then suddenly cooled by ice, about 31 per cent. is converted into the amorphous variety. The proportion of amorphous sulphur formed can be increased by the addition of pyrophosphoric acid or by passing air, sulphur dioxide, or hydrogen chloride through the molten mass; it can be decreased by longer heating, the addition of potassium hydroxide, or by passing nitrogen, carbon dioxide, hydrogen sulphide, or ammonia through the molten mass. The substances, with the exception of carbon dioxide, which have the latter action, will also reduce the amount of any amorphous sulphur previously formed.

R. H. P.

**Relations of Sulphur and Iodine, and the Iodides of Sulphur.** By R. W. EMERSON MACIVOR (*Chem. News*, 1902, 86, 5—7. Compare *ibid.*, 1874, 30, 179).—The evidence in favour of the existence



of the compound  $S_2I_2$  is discussed; the author concludes that this compound has not been obtained, and that the blackish-grey material obtained by heating the elements mixed in atomic proportion, which melts at  $66^\circ$ , and not at  $60^\circ$ , is probably a solid solution. K. J. P. O.

**Theory of the Lead Chamber Process.** By FR. RIEDEL (*Zeit. angew. Chem.*, 1902, 15, 858—864).—A reply to Lunge (this vol., ii, 605) and to Haagn (this vol., ii, 604). The author discusses the question of an optimum temperature in the production of sulphuric acid by the lead chamber process. K. J. P. O.

**Formation of Dithionic Acid.** By UBALDO ANTONY (*Gazzetta*, 1902, 32, i, 514—517).—In a paper by Meyer (this vol., ii, 14) on this subject, no mention is made of the work of the author with Lucchesi (*Abstr.*, 1899, ii, 299) and with Manasse (*Abstr.*, 1899, ii, 753). The author's results have anticipated, and are more comprehensive than, those of Meyer. T. H. P.

**Mixed Crystals of Sulphur and Selenium.** By W. E. RINGER (*Zeit. anorg. Chem.*, 1902, 32, 183—218).—An account is given of all the previous work which has been carried out on mixtures of these two elements and the compounds which they have been said to form.

Molten sulphur and molten selenium are miscible in all proportions, but when the atomic percentage of selenium is greater than 10, crystallisation does not take place easily. Even by very slowly cooling, the mixture solidifies in an amorphous form, and when the percentage of selenium is high, crystallisation can only be made complete by heating for many hours near the melting point. The crystalline mixtures probably contain only mixed crystals; no evidence could be found of the formation of a compound. The following melting points of mixtures were determined by the thermometric and dilatometric methods:

Composition in atomic percentage of selenium.	Thermometric.		Dilatometric.	
	Initial m. p.	Final m. p.	Initial m. p.	Final m. p.
0	118.2°	119°	—	—
10	114	116.5	—	—
20	—	114.2	109°	115°
30	—	108	—	—
40	—	106	100	105
50	—	130	108	130
56	—	—	125	135
60	—	136	—	—
65	—	—	137	149
70	—	150	—	—
74	—	—	147	160
80	—	170.5	160	185
85.5	—	—	162	190
90	—	188	175	200
100	217.4	217.8	—	—

These results are given in the form of a melting point curve.

From the molten mixture, three series of mixed crystals may be formed: (a) monoclinic mixed crystals (of the type of monoclinic sulphur) with 0 to 27 atomic percentage of selenium; (b) monoclinic mixed crystals (of the type of the second monoclinic modification of sulphur?) with about 50 to 82 atomic percentage of selenium; and (c) hexagonal-rhombohedral mixed crystals (of the type of metallic selenium) with  $\pm 87$  to 100 atomic per cent. of selenium.

When selenium is added to sulphur, the transition-point ( $95.5^\circ$ ) from the monoclinic to the rhombic variety is lowered; when 2.05 atomic per cent. of selenium is present the transition point is  $93.5^\circ$ ; with 4.25 atomic per cent. it is  $91-93^\circ$ ; with 7 atomic per cent. it is  $83-86^\circ$ , and with 12 atomic per cent. it is  $76-82^\circ$ . The mixed crystals of series (a) therefore exhibit the same transition from monoclinic to rhombic crystals below a certain temperature that sulphur does. The mixed crystals of the other two series do not show any transition.

At the ordinary temperature, there exist a series of rhombic crystals with 0 to 10 per cent. of selenium, and the second (extending, however, only from 55—75 atomic per cent. of selenium), and the third series just mentioned.

Selenium dissolves in carbon disulphide only to the extent of one part per thousand, but sulphur-selenium mixtures are so soluble that a solution can be obtained containing up to 1 per cent. of selenium.

J. McC.

**Liquid Hydrosol of Selenium.** By ALEXANDER GUTBIER (*Zeit. anorg. Chem.*, 1902, 32, 106—107).—Liquid hydrosol of selenium has already been obtained by Schultze (*Abstr.*, 1886, 302). The hydrosol can be obtained by reducing selenium dioxide in very dilute solution with hydrazine hydrate; the solution is then dialysed. The hydrosol is a reddish liquid when examined by transmitted light and shows a blue fluorescence in reflected light. Electrolytes cause the precipitation of gelatinous red selenium, which becomes black on heating.

Slow evaporation of the hydrosol over concentrated sulphuric acid at diminished pressure occasionally leads to a solid hydrosol.

The pseudo-solution can also be obtained by reduction with hydroxylamine hydrochloride or hypophosphorous acid, but when so prepared, it does not keep well.

J. McC.

**Tellurium.** By ALEXANDER GUTBIER (*Zeit. anorg. Chem.*, 1902, 32, 31—50. Compare *Abstr.*, 1901, ii, 687).—Crude "36 per cent." tellurium from Selmezbánya (Hungary) contains, besides tellurium, antimony, copper, bismuth, and iron; "72 per cent." tellurium of the same origin contains zinc, sulphur, silica, and tellurium dioxide as well as the elements mentioned. The substance sold as "purest" tellurium contains only about 95 per cent. of that element. The Hungarian tellurium contains no selenium. The analysis was made by dissolving the dried substance in a mixture of hydrochloric and nitric acids and evaporating to dryness; the residue was dissolved in hot dilute hydrochloric acid and saturated with hydrogen sulphide at  $70-80^\circ$ . The precipitate contained the sulphides of tellurium,

antimony, copper, and bismuth; it was treated with a warm solution of potassium sulphide, and in the filtrate the tellurium was precipitated by hydrazine hydrate (compare *loc. cit.*). The bismuth was separated from the copper by dissolving the precipitate in nitric acid and precipitating as carbonate. The other metals were estimated in the usual way.

The author does not agree with Köthner (this vol., ii, 67) that the best way to obtain tellurium is from the basic nitrate, but recommends the preparation from telluric acid by freeing this from water of crystallisation at a low temperature, converting it into tellurium dioxide, and reducing this in a current of hydrogen. After distilling two or three times in an atmosphere of hydrogen, the tellurium is obtained quite pure in the form of a tin-white metal which can easily be reduced to a grey powder.

Tellurium is dissolved to a very slight extent by methylene iodide; this is not a purely physical action, but is caused by the formation of a small quantity of tellurium iodide which dissolves.

The chemical behaviour of pure tellurium has been examined. In a fine state of division it is not acted on by the oxygen of the air. It dissolves very readily in hot dilute nitric acid and if the proper amount of acid be used it is difficult to precipitate tellurous acid by the addition of water; the nitric acid solution contains no telluric acid. It dissolves in hot concentrated sulphuric acid to a red solution from which tellurium is separated when water is added. If the red solution be boiled for some time, white crystals of pyrotelluryl sulphate,  $2\text{TeO}_2 \cdot \text{SO}_3$ , separate; the crystals dissolve in hydrochloric acid and decompose on heating with water. No compound analogous to  $\text{KCNSe}$  containing tellurium could be obtained. When concentrated solutions of telluric acid and potassium thiocyanate are boiled together, a yellow, amorphous precipitate containing tellurium, carbon, nitrogen, and sulphur is obtained; this substance, however, is not homogeneous.

J. McC.

**Colloidal Tellurium.** By ALEXANDER GUTBIER (*Zeit. anorg. Chem.*, 1902, 32, 51–54 and 91. Compare this vol., ii, 610).—When a dilute solution of telluric acid (2 to 3 grams per litre) is warmed to about  $50^\circ$  and hydrazine hydrate solution (1:2000) added, a colloidal solution of tellurium is obtained which can be purified in a dialyser. Two modifications of this solution can be formed, a brown and a bluish-green. In reflected light, the solutions show a brown to blue fluorescence, whilst in transmitted light they are clear and transparent. On addition of electrolytes, particularly ammonium chloride, the pseudo-solutions are decomposed. A hydrogel is formed when the solution is boiled or slowly evaporated.

In an additional note, the author states that a pseudo-solution of tellurium can also be obtained from telluric acid by reduction with hydroxylamine hydrochloride, sulphur dioxide, or even by sodium hydrogen sulphite.

J. McC.

**Compounds of Tellurium and Iodine.** By ALEXANDER GUTBIER and F. FLURY (*Zeit. anorg. Chem.*, 1902, 32, 108–114).—When

tellurium and iodine are fused together in the requisite proportion to form tellurium di-iodide,  $\text{TeI}_2$ , a black substance is produced which possesses a metallic lustre and melts easily. When very carefully heated, it can be sublimed, but its composition does not appear to be constant.

Hydriodic acid acts on telluric acid in two ways. In dilute solution, reduction takes place slowly to tellurium dioxide, and after some time, a dark, granular mass of tellurium tetraiodide,  $\text{TeI}_4$ , separates. No indication could be obtained of the formation of a di-iodide. In concentrated solution, the reaction takes place quickly, and tellurium tetraiodide is at once precipitated as a heavy, iron-grey substance. The tetraiodide is decomposed by water according to the equation:  $\text{TeI}_4 + 2\text{H}_2\text{O} = 4\text{HI} + \text{TeO}_2$ , and a similar decomposition takes place with alcohol. When heated, the tetraiodide melts, but at the same time decomposes. The tetraiodide dissolves in ammonia and alkalis; if dilute hydrochloric acid be added to the clear solution, the whole of the iodine separates and can be estimated by titration with thiosulphate. When the substance is dissolved in dilute sodium hydroxide and then neutralised with dilute sulphuric acid, the addition of excess of silver nitrate precipitates a mixture of silver iodide and silver tellurite; these can be separated quantitatively on account of the solubility of the silver tellurite in ammonia solution, and from the ammoniacal solution the tellurium can be precipitated in the usual way.

J. McC.

**Telluric Acid.** By ALEXANDER GUTBIER and F. FLURY (*Zeit. anorg. Chem.*, 1902, 32, 96—105. Compare Abstr., 1901, ii, 687, and this vol., ii, 558).—When telluric acid is prepared by the process suggested by Staudenmaier (Abstr., 1896, ii, 96), namely, by oxidising a nitric acid solution of tellurium dioxide with chromic acid, dark purple crystals separate if too much chromic acid is used. These crystals are hydrated chromic nitrate,  $\text{Cr}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ , and they contain a very small quantity of telluric acid or tellurium nitrate. To obtain pure telluric acid, it is necessary to avoid excess of chromic acid; the telluric acid so obtained is quite colourless. Telluric acid should not be separated from a solution containing sulphuric acid, for the solid substance retains this acid with great tenacity.

When aqueous solutions of telluric acid are evaporated, a turbidity may be produced, but the suspension is so fine that it easily passes through a filter. The telluric acid may, however, separate as a gelatinous, voluminous mass. This substance has been dried in a desiccator and by heating at various temperatures, but no proof could be found of the existence of the telluric acid b,  $\text{H}_2\text{TeO}_4$ , described by Berzelius. The results obtained indicate that, besides telluric acid,  $\text{H}_6\text{TeO}_6$ , and its known easily soluble hydrates, there exist other difficultly soluble hydrates, which all, however, lose water easily when heated, and give tellurium dioxide as the final residue.

J. McC.

**Probable New Oxide of Nitrogen.** By DEMETRIO HELBIG (*Atti R. Accad. Lincei*, 1902, [v], 11, ii, 57).—When a series of electrical discharges is passed through liquid air, a flocculent, greenish



substance is obtained which is very unstable and decomposes at low temperatures with formation of reddish vapours; in some cases, the decomposition is explosive and is accompanied by the evolution of light. All the conditions under which the compound is formed, as also its characters, indicate it to be an oxide of nitrogen, and the author is subjecting it to further study.

T. H. P.

**Hydroxylamine Compounds.** By MAXWELL ADAMS (*Amer. Chem. J.*, 1902, 28, 198—219).—The solubility of hydroxylamine sulphate has been determined with the following results. One gram of an aqueous solution at  $-8^{\circ}$  contains 0.307; at  $0^{\circ}$ , 0.329; at  $10^{\circ}$ , 0.366; at  $20^{\circ}$ , 0.413; at  $30^{\circ}$ , 0.441; at  $40^{\circ}$ , 0.482; at  $50^{\circ}$ , 0.522; at  $60^{\circ}$ , 0.560; and at  $90^{\circ}$ , 0.685 gram of the salt. In the case of hydroxylamine phosphate, 1 gram of an aqueous solution at  $0^{\circ}$  contains 0.012; at  $10^{\circ}$ , 0.015; at  $20^{\circ}$ , 0.019; at  $30^{\circ}$ , 0.027; at  $40^{\circ}$ , 0.040; at  $50^{\circ}$ , 0.055; at  $60^{\circ}$ , 0.077; at  $70^{\circ}$ , 0.102; at  $80^{\circ}$ , 0.133; and at  $90^{\circ}$ , 0.168 gram of the salt.

*Hydroxylamine hydrobromide*,  $\text{NH}_2\cdot\text{OH}\cdot\text{HBr}$ , forms large, white, acicular crystals, and is very soluble in water. *Dihydroxylamine hydrobromide*,  $2\text{NH}_2\cdot\text{OH}\cdot\text{HBr}$ , crystallises in white plates and is readily soluble in water.

The following double salts of mercury and hydroxylamine were prepared and analysed. The *sulphate*,  $\text{HgSO}_4\cdot 2\text{NH}_2\cdot\text{OH}\cdot\text{H}_2\text{O}$ ; the *chloride*,  $\text{HgCl}_2\cdot 2\text{NH}_2\cdot\text{OH}$ , which forms white, acicular crystals, and combines with hydroxylamine hydrochloride with production of the compound  $\text{HgCl}_2\cdot 2\text{NH}_2\cdot\text{OH}\cdot(\text{NH}_2\cdot\text{OH}\cdot\text{HCl})_2$ ; the *chlorides*,

$\text{HgCl}_2\cdot 2\text{NH}_2\cdot\text{OH}\cdot(\text{NH}_2\cdot\text{OH}\cdot\text{HCl})_2$ ,  $\text{HgCl}_2\cdot\text{NH}_2\cdot\text{OH}\cdot\text{HCl}$ , and  $2\text{HgCl}_2\cdot[(\text{NH}_2\cdot\text{OH})_2\cdot\text{HCl}]_5$ ; the *bromide*,  $\text{HgBr}_2\cdot 2\text{NH}_2\cdot\text{OH}\cdot(\text{NH}_2\cdot\text{OH}\cdot\text{HBr})_2$ .

*Cadmium hydroxylamine bromide*,  $\text{CdBr}_2\cdot 2\text{NH}_2\cdot\text{OH}$ , and *iodide*,  $\text{CdI}_2\cdot 3\text{NH}_2\cdot\text{OH}$ , are also described.

E. G.

**Hydrogen Arsenide.** By LUDWIG VANINO (*Zeit. angew. Chem.*, 1902, 15, 856—858).—An arsenic mirror can be obtained in a Marsh's apparatus when 0.02 gram of arsenious oxide is reduced by pure tin and concentrated hydrochloric acid. In the presence of platinum or copper sulphate, 0.0001 gram of arsenious oxide gives a mirror. Aluminium and dilute hydrochloric acid also reduce white arsenic to hydrogen arsenide, 0.0001 gram of the oxide being recognisable in this way; when iron wire and 20 per cent. hydrochloric acid are used, 0.00005 gram of white arsenic can be found.

The author gives a list of the cases of poisoning by hydrogen arsenide which have been recorded.

K. J. P. O

**Action of Hydrogen Sulphide on Arsenic Acid.** By LE ROY W. McCAY (*J. Amer. Chem. Soc.*, 1902, 24, 661—667. Compare Abstr., 1902, ii, 135).—The author explains the formation of mono-, di-, and tri-thio-oxyarsenic acids when hydrogen sulphide acts on arsenic acid by assuming that the latter can dissociate simultaneously in the two directions shown by the equation  $\text{HO}\cdot + \text{H}_2\text{AsO}_3\cdot = \text{H}_3\text{AsO}_4 = \text{H}_2\text{AsO}_4\cdot + \text{H}\cdot$ , and that the ions produced react with those of

hydrogen sulphide to form monothio-oxyarsenic acid, the ions of which, in turn, form in the same way dithio-oxyarsenic acid, and so on until eventually thioarsenic acid results, but this, being unstable, decomposes into arsenic sulphide and hydrogen sulphide. T. A. H.

**Lecture Experiment: Colloidal Silver.** By FRANZ KÜSPERT (*Ber.*, 1902, 35, 2815—2816).—A colloidal solution of silver can be obtained by adding a solution of silver nitrate to a solution of sodium silicate to which formaldehyde has been previously added. The solution, which is quite stable, can be diluted without the precipitation of silver, but it is decomposed by hydrochloric acid, potassium chloride, sodium hydroxide, or hydrogen sulphide. R. H. P.

**The Toning and Fixing of Prints on Silver Chloro-citrate Paper.** By ADOLPHE JOUVE (*Bull. Soc. Chim.*, 1902, [iii], 27, 862—863. Compare this vol., ii, 319).—The author states that in 1898 he published a formula for a combined toning and fixing bath which did not contain any gold; the toning salt was sodium lead thiosulphate in a solution slightly acidified with boric acid. A. F.

**Bleaching Powder.** By HUGO DITZ (*Zeit. angew. Chem.*, 1902, 15, 749—755).—The views expressed by Tiesenholtz (Abstr., 1901, ii, 154) on the process of the formation of bleaching powder are not in agreement with the author's experiments (Abstr., 1901, ii, 239). Evidence is brought forward in favour of the view that bleaching powder is not represented by the expression  $\text{CaCl}_2 \cdot \text{Ca}(\text{OCl})_2 \cdot 2\text{H}_2\text{O}$  (Tiesenholtz), but that all the chlorine is present in the form of a compound,  $\text{CaCl} \cdot \text{OCl} \cdot \text{H}_2\text{O}$ , or of a compound,  $\text{CaO} \cdot \text{CaCl} \cdot \text{OCl} \cdot \text{H}_2\text{O}$ . K. J. P. O.

**Solubility of Gypsum.** By GEORGE E. HULETT and LUCIUS E. ALLEN (*J. Amer. Chem. Soc.*, 1902, 24, 667—679).—Determinations of the solubility were made at thirteen temperatures between  $0^\circ$  and  $107^\circ$ , using a pure natural gypsum and distilled water of conductivity less than  $1.5 \times 10^{-6}$ , special precautions being taken to prevent supersaturation (compare Hulett, Abstr., 1901, ii, 493). The following selections from the determinations made show the character of the solubility curve.

Temp.	Gram in 100 c.c. of solution.	Sp. gr. of solution.	Elect. cond. at temp. quoted.
$0^\circ$	0.1760	1.00197	0.00094
18	0.2017	1.00059	0.00183
35	0.2096	0.99612	0.00268
40	0.2097	0.99439	0.00284
45	0.2086	0.99237	0.00304
65.3	0.1934	0.98256	0.00360
100	0.1881	—	—

The solubilities observed are lower than those found by Marignac (*Ann. Chim. Phys.*, 1874, [v], 1, 274) and by Droeze (*Ber.*, 1877, 10, 330), whilst the point of maximum solubility observed is  $40^\circ$ , instead

of 38° as found by these observers. Similarly, the values of  $\lambda$  are lower than those obtained by Kohlrausch and Rose (Abstr., 1894, ii, 7), these differences being due to the elimination of supersaturation in the present work.

T. A. H.

**Behaviour of Magnesium Chloride in a Steam Boiler.** By HERMANN OST (*Chem. Zeit.*, 1902, 26, 819—822).—The action of water on iron in the presence of air at 100° is assisted by the presence of chlorides; magnesium chloride, however, does not behave differently from other chlorides. In the absence of air, magnesium chloride corrodes iron far more readily than other chlorides. It is shown that this action is not due to the formation of hydrochloric acid, as has been supposed by Wagner; for the presence of hydrochloric acid cannot be demonstrated in tin, copper, or iron boilers at high pressures or temperatures. The author experimented with a small iron boiler, using a pressure of 10 atmospheres and a temperature of 183°; with 5 per cent. solutions of magnesium chloride, potassium chloride, sodium sulphate, potassium sulphate, calcium chloride, and magnesium sulphate, the iron was attacked in each case, in the absence of air, even at 100°, and covered by a black layer of magnetic oxide; only in the case of magnesium salts did iron pass into solution. The oxidation and dissolution of the iron are not proportional; the former is the greater when calcium chloride, potassium chloride, potassium sulphate, or sodium sulphate is used. Since the action of magnesium chloride is not due to the formation of hydrochloric acid, neutral magnesium salts must interact with ferrous oxide. When a mixture of ferric hydroxide and iron powder, which immediately react to form the magnetic oxide, is treated with a solution of magnesium chloride at 100°, iron passes into solution as chloride; conversely, a solution of ferrous sulphate reacts with magnesium powder, forming ferrous hydroxide and magnesium sulphate. The reversible reaction is expressed by the equation:  $\text{MgCl}_2 + \text{Fe(OH)}_2 \rightleftharpoons \text{FeCl}_2 + \text{Mg(OH)}_2$ .

Several different kinds of iron were tested by heating with salt solutions at 100°; in the case of all the salts just mentioned, and also with alum, the iron is attacked in the absence of air and hydrogen evolved; with alum and magnesium salts, the iron passes into solution. If hard, instead of distilled, water is used, the iron is attacked to a much less extent.

When solutions of magnesium salts are heated with calcium carbonate under a pressure of 10 atmospheres, basic magnesium carbonate, magnesium oxide, and calcium salts are formed (compare Röhrig and Treumann, *Zeit. öffentl. Chem.*, 1900, 6, 241); even in the presence of large excess of calcium carbonate, the decomposition is not complete. Since calcium salts do not cause the dissolution of the iron, the presence of calcium carbonate stops the injurious action of magnesium salts; it is found that at a pressure of 10 atmospheres it is only necessary to have present a quantity of calcium carbonate sufficient to decompose a fourth of the magnesium salts in order to prevent entirely the dissolution of iron. Under a pressure of 5 atmospheres, no action takes place with the proportion of  $2\frac{1}{2}$  parts of magnesium chloride to 1 part of calcium carbonate.

K. J. P. O.

**Cadmium Suboxides.** By SIMEON M. TANATAR and M. LEVIN (*J. Russ. Phys. Chem. Soc.*, 1902, **34**, 495—501. Compare Abstr., 1901, ii, 553).—The authors have prepared two suboxides of cadmium from the masses obtained when mixtures of cadmium oxalate and oxide are heated together. When molecular proportions of the two are heated in a glass tube, carbon mono- and di-oxides are evolved, and a dark green powder of the composition  $\text{Cd}_3\text{O}_2$  are obtained:  $3(\text{CdC}_2\text{O}_4 + \text{CdO}) = 2\text{Cd}_3\text{O}_2 + 5\text{CO}_2 + \text{CO}$ . This suboxide is decomposed by dilute hydrochloric acid with formation of cadmium chloride and very finely divided metallic cadmium. When heated, in absence of air, above its temperature of formation, the oxide is decomposed into cadmium and cadmium oxide. That this compound is not merely a mixture of cadmium and the oxide is shown by its colour, by the thermochemical data, and by the observation that it is not attacked by mercury. In presence of water, this suboxide is gradually decomposed into the hydroxide and metallic cadmium.

When the mixture heated is composed of one mol. of the oxide to two of cadmium oxalate, the reaction taking place is as follows:  $4\text{CdC}_2\text{O}_4 + 2\text{CdO} = 3\text{Cd}_2\text{O} + 7\text{CO}_2 + \text{CO}$ . This oxide, which in colour closely resembles the compound  $\text{Cd}_3\text{O}_2$ , is decomposed by dilute hydrochloric acid according to the equation:  $\text{Cd}_2\text{O} + 2\text{HCl} = \text{CdCl}_2 + \text{H}_2\text{O} + \text{Cd}$ . In presence of water, or when heated in absence of air, this oxide yields cadmium and cadmium oxide. Mercury is incapable of removing cadmium from this compound.

T. H. P.

**Thallic Chloride.** By RICHARD JOS. MEYER (*Zeit. anorg. Chem.*, 1902, **32**, 72—77).—In reply to Cushman's criticism (this vol., ii, 322) of the author's former paper (Abstr., 1900, ii, 655), it is pointed out that under certain conditions the chlorine of thallic chloride is not completely precipitated by silver nitrate. The reason for this is that silver chloride is soluble in a solution of thallic nitrate; the solubility probably depends on the formation of a double salt of silver chloride and thallic nitrate.

In spite of the fact that Cushman could not obtain it, the formation and existence of the compound with ether,  $\text{TiCl}_3 \cdot \text{Et}_2\text{O}$ , is quite certain. The best method for preparing it is to pour ether over hydrated thallic chloride,  $\text{TiCl}_3 \cdot 4\text{H}_2\text{O}$ , then separate the two layers and cool the ethereal solution in a freezing mixture, when the dissolved tetrahydrate crystallises. The ethereal solution is then placed in a desiccator over sulphuric acid, and the ether evaporated under diminished pressure. The ether compound separates in crystals. In a vacuum, it loses ether and leaves anhydrous thallic chloride. By the action of light, the ether compound is reduced, and thallos-thallic chloride is produced. The ether compound melts below  $30^\circ$ , whilst the tetrahydrate melts at  $43^\circ$ .

The author raises objection to the structural formulæ proposed by Cushman for thallic chloride tetrahydrate and its double salts.

J. McC.

**Behaviour of Salt Solutions towards Copper and towards Iron in the Presence of Copper.** By HERMANN OST (*Chem. Zeit.*, 1902, **26**, 845—847. Compare preceding page).—When heated in



a copper boiler under a pressure of 10 atmospheres, a 5 per cent. solution of magnesium chloride dissolves copper. Similar experiments with sodium chloride and sulphate show that the copper is dissolved only in the former case; the solution of copper is colourless, and on standing deposits a pale green precipitate.

The majority of metallic chlorides are able, at  $100^{\circ}$ , to dissolve copper as cuprous chloride from cuprous oxide, or from a mixture of copper and cupric oxide. Sulphates have no such power. Pure cupric oxide is not dissolved; further, copper free from oxide is not attacked. The interior of the copper boiler could not be freed from oxide.

When iron is put in the copper boiler, dissolution of the copper does not occur; the iron becomes covered with a layer of magnetic oxide, and hydrogen is evolved; in the presence of magnesium salts, iron is dissolved. The author suggests that the corrosive action of sea-water on copper pipes might be lessened if iron were present in the copper.

K. J. P. O.

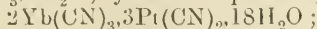
**Chemistry of Monazite Sand.** By G. PAUL DROSSEBACH (*Ber.*, 1902, 35, 2826—2831).—Erbium can be separated from a mixture of basic nitrates (rich in erbium) by extraction with a solution of ammonium chloride, or with a small quantity of hydrochloric acid, thus eliminating a mixture of colourless compounds, principally of yttrium.

“Didymium” carbonate is best separated by precipitating (with a dilute solution of an alkali carbonate) its solution in a saturated solution of potassium carbonate, the precipitate thus obtained, when converted into chloride, giving the neodymium spectrum and also that of erbium and samarium. The separation of this mixture by the fractional crystallisation of the double nitrates of magnesium and the earths in question is described in detail.

The paper concludes with a discussion of various methods of separating cerium from lanthanum and didymium.

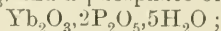
R. H. P.

**Ytterbium.** By ASTRID CLEVE (*Zeit. anorg. Chem.*, 1902, 32, 129—163).—Ytterbium has been extracted from various minerals, and after careful purification the atomic weight, determined by conversion of the oxide into sulphate, is 173.11 (three determinations). Ytterbium forms only one oxide,  $\text{Yb}_2\text{O}_3$ , which is colourless and not radioactive. The following ytterbium salts have been prepared. Ytterbium chloride,  $\text{YbCl}_3 \cdot 6\text{H}_2\text{O}$ , which is easily soluble in water, forms clear crystals, and decomposes at  $100^{\circ}$ ; the oxychloride,  $\text{YbOCl}$ , has not been obtained quite pure; the bromide,  $\text{YbBr}_3 \cdot 8\text{H}_2\text{O}$ ; the iodate,  $\text{Yb}(\text{IO}_3)_3 \cdot 6\text{H}_2\text{O}$ ; the periodate,  $\text{YbIO}_5 \cdot 2\text{H}_2\text{O}$ ; two double salts of ytterbium chloride with platinum chloride,  $2\text{YbCl}_3 \cdot \text{PtCl}_4 \cdot 22\text{H}_2\text{O}$  and  $2\text{YbCl}_3 \cdot \text{PtCl}_4 \cdot 35\text{H}_2\text{O}$ ; ytterbium hydrogen platinibromide,  $\text{YbBr}_3 \cdot 3\text{H}_2\text{PtBr}_6 \cdot 30\text{H}_2\text{O}$ ; no normal double bromide could be obtained; ytterbium aurichloride,  $\text{YbCl}_3 \cdot \text{AuCl}_3 \cdot 9\text{H}_2\text{O}$ ; ytterbium platinoeyanide,



potassium ytterbium ferrocyanide,  $\text{KYbFe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$ ; two nitrates,  $\text{Yb}(\text{NO}_3)_3 \cdot 3\text{H}_2\text{O}$  and  $\text{Yb}(\text{NO}_3)_3 \cdot 4\text{H}_2\text{O}$ , the former by slow crystallisation from a neutral solution, the latter from a nitric acid solution; the sulphate,  $\text{Yb}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}$ , the solubility of which

diminishes as the temperature rises, 100 parts of water dissolve 44.2 parts of anhydrous sulphate at 0°, 11.5 parts at 55°, and 4.67 parts at 100°; the sulphite,  $\text{Yb}_2(\text{SO}_3)_3 \cdot 9\text{H}_2\text{O}$ ; the ethylsulphate,  $\text{Yb}(\text{EtSO}_4)_3 \cdot 9\text{H}_2\text{O}$ , which begins to decompose at 70°; two selenates,  $\text{Yb}_2(\text{SeO}_4)_3 \cdot 15\text{H}_2\text{O}$  and  $\text{Yb}_2(\text{SeO}_4)_3 \cdot 8\text{H}_2\text{O}$ , both of which give anhydrous selenate when heated at 110—120°; the carbonate,  $\text{Yb}_2(\text{CO}_3)_3 \cdot 4\text{H}_2\text{O}$ , and a basic carbonate,  $\text{OH} \cdot \text{YbCO}_3 \cdot \text{H}_2\text{O}$ ; the orthophosphate,  $\text{YbPO}_4 \cdot 4.5\text{H}_2\text{O}$ , the metaphosphate,  $\text{Yb}(\text{PO}_3)_3$ , and a phosphate of the formula



two vanadates,  $3\text{Yb}_2\text{O}_3 \cdot 5\text{V}_2\text{O}_5 \cdot 3\text{H}_2\text{O}$  and  $\text{Yb}_2\text{O}_3 \cdot 15\text{V}_2\text{O}_5$ ; a basic potassium ytterbium chromate,  $\text{K}_2\text{Yb}_2(\text{CrO}_4)_2 \cdot \text{Yb}(\text{OH})_3 \cdot 15.5\text{H}_2\text{O}$ ; two molybdates,  $\text{Yb}_2\text{O}_3 \cdot 7\text{MoO}_3 \cdot 6\text{H}_2\text{O}$  and  $2\text{Yb}_2\text{O}_3 \cdot \text{MoO}_3$ ; the metatungstate,  $\text{Yb}_2\text{O}_3 \cdot 12\text{WO}_3 \cdot 35\text{H}_2\text{O}$ ; the oxytungstate,  $(\text{YbO})_2\text{WO}_4$ , which is interesting as being the first instance of the formation of a univalent positive radicle amongst the rare earths; two sodium ytterbium tungstates,  $2\text{Yb}_2\text{O}_3 \cdot 4\text{Na}_2\text{O} \cdot 7\text{WO}_3$  and  $\text{Yb}_2\text{O}_3 \cdot 9\text{Na}_2\text{O} \cdot 12\text{WO}_3$ ; the formate,  $\text{Yb}(\text{HCO}_2)_3 \cdot 2\text{H}_2\text{O}$ ; the acetate,  $\text{Yb}(\text{C}_2\text{H}_3\text{O}_2)_3 \cdot 4\text{H}_2\text{O}$ ; the propionate crystallises either with  $3\text{H}_2\text{O}$  or  $\text{H}_2\text{O}$ ; ytterbium hydrogen malonate,  $\text{YbH}(\text{C}_3\text{H}_2\text{O}_4)_2$ ; the succinate,  $\text{Yb}_2(\text{C}_4\text{H}_4\text{O}_4)_3 \cdot 3\text{H}_2\text{O}$ ; the lactate,  $\text{Yb}(\text{C}_3\text{H}_5\text{O}_3)_3 \cdot 2\text{H}_2\text{O}$ ; ytterbium hydrogen tartrate,  $\text{YbH}(\text{C}_4\text{H}_4\text{O}_6)$ , crystallises with  $2\text{H}_2\text{O}$  or  $12\text{H}_2\text{O}$ ; ytterbium hydrogen citrate,  $\text{Yb}_2\text{H}_3(\text{C}_6\text{H}_5\text{O}_7)_3 \cdot 12\text{H}_2\text{O}$  or with  $15\text{H}_2\text{O}$ ; the benzoate,  $\text{Yb}(\text{C}_7\text{H}_5\text{O}_2)_3$ ; and the picrate,  $\text{Yb}[\text{C}_6\text{H}_2(\text{NO}_2)_3\text{O}]_3 \cdot 8\text{H}_2\text{O}$ .

The conductivities of solutions of ytterbium sulphate from  $v = 3.33$  to  $v = 16667$  have been measured. Ytterbium sulphate is hydrolysed to a certain extent in dilute solution.

The oxalate is about ten times as soluble in ammonium oxalate solution as yttrium oxalate. The oxalate is also appreciably soluble in sulphuric acid.

The composition of the salts obtained clearly shows the tervalency of ytterbium. The composition of its platinocyanide shows that it is to be grouped with yttrium, erbium, and gadolinium. J. McC.

**Electrolytic Preparation of New Alloys.** By ALFRED COEHN (*Zeit. Elektrochem.*, 1902, 8, 591—593).—From solutions of magnesium and nickel sulphates, alloys of the two metals may be deposited. These may contain as much as 10 per cent. of magnesium. The deposits are more coherent than those of pure nickel obtained in similar circumstances. T. E.

**Behaviour of Chromium prepared by the "Aluminothermal Method" towards Hydrochloric Acid.** By THEODOR DÖRING (*J. pr. Chem.*, 1902, [ii], 66, 65—103. Compare Brauer, *Abstr.*, 1901, ii, 635).—The three samples of chromium employed contained respectively 97.95, 97.41, and 93.67 per cent. of metallic chromium. As commercial aluminium always contains iron, silicon, manganese, sulphur, and phosphorus, the presence of these impurities in chromium prepared by Goldschmidt's process is difficult to avoid. The chromium dissolves, with evolution of hydrogen, in moderately concentrated hydrochloric acid at the ordinary temperature, and in very dilute acid on gentle warming. The least pure chromium enters into reaction most easily. The chromous chloride formed by solution of the chromium in hydro-

chloric acid is converted, by a secondary reaction, into chromic chloride, the change being complete if the reaction is carried out at the ordinary temperature, but less than complete if at 100°. This change is ascribed to a catalytic action of silica. If air is excluded, chromous chloride is stable in neutral solution, but in hydrochloric acid solution it has a tendency to form chromic chloride; the reaction, which is accompanied by evolution of hydrogen, is extremely slow, but is markedly accelerated by addition of platinum black, finely divided gold, or silica. The formation of chromic chloride from chromous chloride in acid solution takes place according to the equation:  $2\text{CrCl}_2 + 2\text{HCl} \rightleftharpoons 2\text{CrCl}_3 + \text{H}_2$ , and is a reversible reaction.

Ostwald's periodic curve (Abstr., 1900, ii, 730; 1901, ii, 24) is probably the resultant of two curves representing the formation of chromous chloride and its conversion into chromic chloride.

G. Y.

**Oxidisability of Chromic Hydroxide.** By UBALDO ANTONY and PAOLI (*Gazzetta*, 1902, 32, i, 518—525).—If excess of alkali hydroxide be added to a solution containing a chromium and a manganese salt in the proportion Mn:8Cr (O=16), no precipitate is obtained, but the liquid is coloured emerald green and must be regarded as a colloidal solution of the hydroxides of chromium and manganese, since this behaviour is only exhibited when the salts are present in exactly the above ratio. Chromium being trivalent and having both an acid and basic function, whilst manganese is bivalent and decidedly metallic in its properties, there is no doubt that they exist in this solution in the form of a salt, an electrolyte, which must be either a manganous chromite or polychromite. When this liquid is exposed to the air, or, better, when oxygen is passed through it, it quickly turns brown but remains free from precipitate. The element undergoing the oxidation is the manganese which becomes quadrivalent; the rôles of the two elements thus become interchanged and a more or less basic chromium manganite is formed. The chromium hydroxide now begins to undergo oxidation and the amount of chromate formed in the solution increases until about 60 per cent. of the chromium has been converted. Continued action of oxygen has now no further effect on the liquid which, after a time, deposits a dark precipitate of constant composition, the proportion Mn:Cr having the value 1:3; when this compound is treated with cold dilute sulphuric acid, the chromium dissolves as sulphate whilst the manganese remains in solution as the hydrate of manganese dioxide. If now to this liquid is added an alkaline solution of chromium hydroxide, the latter undergoes immediate and complete oxidation.

The velocity with which this oxidising action proceeds was also investigated.

T. H. P.

**Ammonium Tungstates.** By THOMAS M. TAYLOR (*J. Amer. Chem. Soc.*, 1902, 24, 629—643).—Ammonium paratungstate,  $(\text{NH}_4)_{10}\text{W}_{12}\text{O}_{41}$ , crystallises in needles with 11H<sub>2</sub>O and in plates with 5H<sub>2</sub>O. Both forms when heated begin to lose ammonia at 60°. When boiled in aqueous solution for several days, they yield the meta-

tungstate,  $(\text{NH}_4)_2\text{W}_4\text{O}_{13}\cdot 8\text{H}_2\text{O}$ , which crystallises in tetragonal octahedra and begins to lose ammonia at  $120^\circ$ . Any one of the foregoing salts when heated at  $250^\circ$  is converted into a glass-like, colloidal tungstate of the formula  $(\text{NH}_4)_2\text{W}_6\text{O}_{19}\cdot 4$  or  $6\text{H}_2\text{O}$ . The latter is miscible in all proportions with water and absorbs ammonia readily, thereby reverting to the "meta"-salt, which in its turn passes into the undeca-hydrated "para"-salt in an atmosphere of moist ammonia. When the latter is heated in contact with dry ammonia, it loses water and absorbs ammonia, the following salts being stable under these conditions at the temperatures mentioned:

At $100^\circ$ .....	$6(\text{NH}_4\text{OH}, 2\text{WO}_3), \text{NH}_4\cdot\text{OH}, 4\text{NH}_3$ .
Between $110^\circ$ and $120^\circ$ , and at $150^\circ$ .....	$6(\text{NH}_4\text{OH}, 2\text{WO}_3), \text{NH}_4\cdot\text{OH}, 5(\text{NH}_3)$ .
Between $130^\circ$ and $140^\circ$ .....	$6(\text{NH}_4\text{OH}, 2\text{WO}_3), \text{NH}_4\cdot\text{OH}, 6(\text{NH}_3)$ .
At $160^\circ$ .....	$6(\text{NH}_4\text{OH}, 2\text{WO}_3), 2\text{NH}_4\cdot\text{OH}, 2\text{NH}_3$ .
„ $200^\circ$ .....	$6(\text{NH}_4\text{OH}, 2\text{WO}_3), 2\text{NH}_4\cdot\text{OH}, \text{NH}_3$ .
„ $250^\circ$ .....	$4(\text{NH}_4\text{OH}, 2\text{WO}_2), 4\text{WO}_3, 4\text{NH}_3$ .

These salts are all unstable in air and in contact with water give off ammonia and revert to the stable undeca-hydrated "para"-salt. The para- and meta-tungstates may also be formulated in this manner, their temperatures of formation being added for comparison:

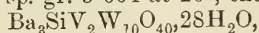
Below $100^\circ$ , "para-needles" ...	$6(\text{NH}_4\text{OH}, 2\text{WO}_3), 4\text{NH}_4\cdot\text{OH}, 6\text{H}_2\text{O}$ .
At $100^\circ$ , "para-plates" .....	$6(\text{NH}_4\text{OH}, 2\text{WO}_3), 4\text{NH}_4\cdot\text{OH}, 6\text{H}_2\text{O}$ .
„ $150^\circ$ , "meta-salt" .....	$2(\text{NH}_4\text{OH}, 2\text{WO}_3), 7\text{H}_2\text{O}$ .
„ $250^\circ$ , colloidal salt .....	$2(\text{NH}_4\text{OH}, 2\text{WO}_3), 2\text{WO}_3, 3$ or $5\text{H}_2\text{O}$ .

From this it appears that a common nucleus  $(2\text{NH}_4\text{OH}, 4\text{WO}_3)$  runs through the whole series and that the more complex members of the group are polymerides and additive compounds derivable from this.

T. A. H.

**Silicovanadotungstates.** By CARL FRIEDHEIM and WILLIAM HOPE HENDERSON (*Ber.*, 1902, 35, 3242—3251. Compare *Abstr.*, 1900, ii, 483).—Silicovanadotungstates can be obtained by the action of hydrofluosilicic acid on a mixture of tungstate with vanadate. From the product of reaction of ammonium vanadate on ammonium silicotungstate, an *ammonium silicovanadotungstate* of the formula  $(\text{NH}_4)_6\text{SiV}_2\text{W}_{10}\text{O}_{40}\cdot 21\text{H}_2\text{O}$  has been obtained. It forms reddish-brown, octahedral crystals of sp. gr. 3.428 at  $20^\circ$ . One c.c. of its saturated solution at  $17^\circ$  contains 0.6652 gram of the hydrated salt. If the product be not evaporated to dryness, but subjected to fractional crystallisation, a salt of the formula  $(\text{NH}_4)_6\text{SiV}_2\text{W}_9\text{O}_{37}\cdot 24\text{H}_2\text{O}$  is obtained having a sp. gr. 3.396. Two series of salts have been produced, a deca-series with the ratio of  $\text{SiO}_2$  to  $\text{WO}_3$  1 : 10, and a nono-series with the ratio 1 : 9.

The deca-salts which have been prepared are: *Sodium silicovanadotungstate*,  $\text{Na}_6\text{SiV}_2\text{W}_{10}\text{O}_{40}\cdot 29\text{H}_2\text{O}$ , in reddish-brown crystals of sp. gr. 3.344° at  $20^\circ$ ; the *potassium* salt,  $\text{K}_6\text{SiV}_2\text{W}_{10}\text{O}_{40}\cdot 22\text{H}_2\text{O}$ , in the form of reddish crystals with a sp. gr. 3.664 at  $20^\circ$ , the *barium* salt,





with a sp. gr. 3.66 at 20°. One c.c. of the saturated solution of the barium salt contains 0.0384 gram of salt. A *potassium ammonium* salt,  $\text{NH}_4\text{K}_5\text{SiV}_2\text{W}_{10}\text{O}_{40}, 23\text{H}_2\text{O}$ , soluble to such an extent that 1 c.c. of its saturated solution contains 0.5072 gram, and an *ammonium potassium barium* salt,  $(\text{NH}_4)_2\text{K}_2\text{BaSiV}_2\text{W}_{10}\text{O}_{40}, 25\text{H}_2\text{O}$ , which crystallises in holohedral forms of the regular system, have also been obtained. Potassium and barium nono-salts are obtained at the same time as the deca-salts. By the action of potassium silicotungstate on potassium vanadate, a salt of the formula  $\text{K}_{14}\text{Si}_2\text{V}_6\text{W}_{18}\text{O}_{80}, 42\text{H}_2\text{O}$  is produced, and it gives the salt  $\text{K}_{12}\text{Si}_2\text{V}_6\text{W}_{18}\text{O}_{79}, 31\text{H}_2\text{O}$  on recrystallising from water; both these are red solids which form crystals belonging to the monoclinic system. The *barium nono*-salts are:  $\text{Ba}_7\text{Si}_2\text{V}_4\text{W}_{18}\text{O}_{80}, 83\text{H}_2\text{O}$  and  $\text{Ba}_6\text{Si}_2\text{V}_4\text{W}_{18}\text{O}_{79}, 50\text{H}_2\text{O}$ ; they are both red and form rhombic crystals.

These salts are all decomposed by concentrated acids or alkalis; they give characteristically coloured precipitates with lead, silver, and mercurous salts. J. McC.

**Pertungstic, Hyperuranic, and Pervanadic Acids.** By L. PISSARJEWSKY (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 472—483).—The author has made determinations of the distribution of hydrogen peroxide between ether and water in solutions containing tungstic acid which reacts with the peroxide forming pertungstic acid. From the results obtained, it is concluded that, in aqueous solution in presence of a large quantity of free hydrogen peroxide, pertungstic acid decomposes according to the equation:  $\text{WO}_3 \cdot 2\text{H}_2\text{O}_2 \rightleftharpoons \text{WO}_3 \cdot \text{H}_2\text{O}_2 + \text{H}_2\text{O}_2$ , whilst when less free hydrogen peroxide is present, a certain amount of further decomposition also takes place, according to the equation:  $\text{WO}_3 \cdot \text{H}_2\text{O}_2 \rightleftharpoons \text{WO}_3 + \text{H}_2\text{O}_2$ .

Similar experiments with sodium hyperuranate indicate that in aqueous solution this salt undergoes decomposition with evolution of hydrogen peroxide.

When dissolved in hydrogen peroxide, vanadium pentoxide yields pervanadic acid.

The author discusses the constitution of these hyper-acids and considers that those acids which, when acted on by sulphuric acid, give up hydrogen peroxide may be regarded as salts of the latter in which one atom of hydrogen is replaced by the radicles  $\text{VO}_2$ ,  $\text{WO}_2$ , &c. Thus, for example, pervanadic acid would be  $\text{VO}_2(\text{O}_2\text{H})$ . T. H. P.

**Some Vanadium Compounds of the Type  $\text{VX}_2$ .** By AUGUSTO PICCINI and L. MARINO (*Zeit. anorg. Chem.*, 1902, 32, 55—71. Compare Abstr., 1899, ii, 297).—By the electrolytic reduction of vanadic anhydride in presence of sulphuric acid, *vanadous sulphate*,  $\text{VSO}_4 \cdot 7\text{H}_2\text{O}$ , is produced. This is violet and very readily oxidised. It forms monoclinic crystals which are isomorphous with  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ . It is very easily soluble in water. When ammonium vanadate is electrolytically reduced in presence of sulphuric acid, *vanadous ammonium sulphate*,  $\text{VSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$ , is formed; it is reddish-violet and not so easily oxidised as vanadous sulphate. Its crystals are monoclinic and isomorphous with double salts of magnesium sulphate.

*Vanadous potassium sulphate*,  $\text{VSO}_4 \cdot \text{K}_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$ , is formed by electrolytically reducing vanadium pentoxide along with sulphuric acid, then adding potassium sulphate, and continuing the electrolysis. It is not so highly coloured as the corresponding ammonium salt. In the same way, vanadous rubidium sulphate is formed, but it has not been possible to obtain it free from vanadium rubidium alum.

Mixed crystals of vanadous and magnesium sulphates,  
 $(\text{V}, \text{Mg})\text{SO}_4 \cdot 7\text{H}_2\text{O}$ .

and of vanadous and ferrous sulphates,  $(\text{V}, \text{Fe})\text{SO}_4 \cdot 7\text{H}_2\text{O}$ , have been formed in various proportions and it has also been shown that vanadous sulphate forms mixed crystals with chromic and other sulphates. The isodimorphism is thus proved.

If vanadic chloride solution is electrolytically reduced, using a graphite anode, the solution becomes violet, but it has not been possible to isolate vanadous chloride.

The following reactions of vanadous salts have been observed. With sodium hydroxide, a greyish-violet precipitate is obtained which quickly becomes green. Sodium carbonate gives a violet precipitate which decomposes at once. Sodium sulphide gives a violet precipitate which decomposes with evolution of hydrogen and hydrogen sulphide. With potassium nitrate and hydrochloric acid, there is an evolution of nitric oxide. From salts of tin, silver, gold, and platinum, the metal is precipitated by a solution of a vanadous salt; in the same way, copper is deposited quantitatively from its solution. It is worthy of note that chromous salts only reduce cupric salts to cuprous oxide (Peters, *Abstr.*, 1898, ii, 419). These reactions show that the vanadous compounds are to be classed amongst the most energetic inorganic reducing agents.

Attempts have been made to produce titanium compounds of the type  $\text{TiX}_2$ , but so far these have not been successful. J. McC.

**Action of Salts on Gold Chloride.** By WILLIAM OECHSNER DE CONINCK (*Bull. Acad. roy. Belg.*, 1902, 316—318).—When equal volumes of dilute aqueous solutions of manganous sulphate and gold chloride are mixed and placed in the dark, metallic gold, in the form of a brown powder with a violet sheen, begins to be precipitated after from 10 to 12 days. Precipitation occurs at once if the mixture be heated to the boiling point, but sunlight exerts no accelerating influence. Uranous sulphate, under the same conditions, reduces auric chloride even more slowly; the metal is precipitated, in this case, in the form of thin films with a metallic lustre. The action is accelerated by sunlight but not by the application of heat. Manganous chloride reduces gold chloride with extreme slowness, and the mixed solutions do not deposit gold even on boiling. In sunlight, precipitation rapidly occurs. This, the author believes, is due to the influence of the radiant energy of sunlight in destroying the state of equilibrium between the reactions represented by the equation  $\text{MnCl}_2 + \text{AuCl}_3 \rightleftharpoons \text{MnCl}_4 + \text{AuCl}$ . T. A. H.

**Pulverisation and Recrystallisation of the Platinum Metals** By LUDWIG HOLBORN and F. HENNING\* (*Sitzungsber. K. Akad. Wiss. Berlin*, 1902, 936—943).—The thermoelement platinum | platinum-irid-

ium exhibits considerable change in its *E.M.F.* after the wires have been kept at a high temperature by the passage of a current; the change in the thermoelement platinum | platinum-rhodium is very much smaller. It is now shown that when iridium and platinum-iridium alloys are kept by an electric current at a temperature near their melting point, they gradually lose in weight; the corresponding loss of weight for platinum, rhodium, and platinum-rhodium alloys is much smaller.

The authors describe how, by prolonged heating and subsequent etching, the platinum metals and their alloys, as well as gold and silver, may be obtained in a crystalline form; this part of the paper is illustrated with photographic reproductions. J. C. P.

## Mineralogical Chemistry.

**Dopplerite.** By HEINRICH IMMENDORFF (*Bied. Centr.*, 1902, 31, 580—582; from *Mitt. Ver. Förd. Moorkultur*, 1900, 227).—Three samples of dopplerite from (1) Oldenburg, (2) Hanover and (3) Switzerland were examined. The acidity was determined by passing hydrogen through water in which the powdered substance and calcium carbonate were suspended, both at the ordinary temperature and at 100°. The results, expressed in carbon dioxide per cent. of the dried substance, were as follows: 2.79, 1.07 and 1.52 at the ordinary temperature, and 4.43, 2.29 and 2.61 per cent. when boiled.

The dry matter of the three samples had the following percentage composition:

	Ash.	CaO.	MgO.	Fe <sub>2</sub> O <sub>3</sub> & Al <sub>2</sub> O <sub>3</sub> .	P <sub>2</sub> O <sub>5</sub> .	Insoluble in HCl.
1.	3.28	0.16	0.09	1.64	0.12	0.82
2.	2.46	0.57	0.38	1.01	0.06	0.30
3.	5.48	2.73	0.07	0.85	0.19	0.68

The organic matter of the two German samples contained carbon (1) 85.23, (2) 60.12; hydrogen, 4.77 and 5.26; nitrogen, 1.45 and 1.88; oxygen (and sulphur), 35.55 and 32.75 per cent.

N. H. J. M.

**Minerals from Casal di Pari** (in the Province of Grosseto, Italy). By G. DE ANGELIS D'OSSAT (*Atti R. Accad. Lincei*, 1902, [v], 11, i, 548—555).—There are three distinct mineral beds near Casal di Pari containing mainly antimony, lead, and mercury. In the oldest bed, known as Selva, are found stibnite (free from arsenic or lead), cervantite, stibiconite or antimonochre, sulphur, pyrites, hæmatite, gypsum and quartz. That of S. Antonio and Val d'Aspra contains galena, cinnabar, pyrites, chalcopyrite, fluorite, quartz,

limonite, azurite, malachite, calcite and gypsum. The third deposit, Miniera di Casale, is composed of quartz, pyrites, sulphur and cinnabar.

From the observations made by the author, he attributes the origin of these mineral deposits of antimony and galena to metasomatism. The cinnabar must then be regarded as a metalliferous impregnation of the quartzose vein with a formation analogous to, but not equally rich with, the cinnabar-containing quartzose veins of Almaden.

T. H. P.

Formation of Oceanic Salt Deposits, particularly of the Stassfurt Beds. XXVII. Artificial Preparation of Pinnoite. By JACOBUS H. VAN'T HOFF and GIUSEPPE BRUNI (*Sitzung-ber. K. Akad. Wiss. Berlin*, 1902, 805—807).—In beginning the study of the conditions under which boracite is naturally formed, the authors have obtained pinnoite ( $\text{MgO}, \text{B}_2\text{O}_3, 3\text{H}_2\text{O}$ ) by the dehydration in warm magnesium chloride solution of Wöhler's octohydrate,  $\text{MgO}, \text{B}_2\text{O}_3, 8\text{H}_2\text{O}$ .

J. C. P.

Leonite from Leopoldshall. By J. E. STRANDMARK (*Zeit. Kryst. Min.*, 1902, 36, 461—465).—Analysis of perfectly clear crystals of leonite gave results agreeing with those required for the formula  $\text{K}_2\text{SO}_4, \text{MgSO}_4, 4\text{H}_2\text{O}$ . The massive material is rendered impure by the presence of 0.5 to more than 7 per cent. of chlorine. Crystallographic measurements confirm Tenne's results (*Abstr.*, 1897, ii, 268), which, in not having been obtained from the same material as that analysed, were somewhat doubtful. Leonite is isomorphous with the artificial salt,  $\text{K}_2\text{SO}_4, \text{MnSO}_4, 4\text{H}_2\text{O}$ , but not with blödite ( $\text{Na}_2\text{SO}_4, \text{MgSO}_4, 4\text{H}_2\text{O}$ ). Twinned crystals of leonite were artificially prepared.

L. J. S.

Dolerophanite as a Furnace Product. By J. E. STRANDMARK (*Zeit. Kryst. Min.*, 1902, 36, 456—460).—Dolerophanite is formed in the crevices of the bed of a copper-furnace at Atvidaberg in East Gotland, Sweden. The small, brown and brilliant crystals were found to contain:  $\text{CuO}$ , 65.95;  $\text{SO}_3$ , 34.43 per cent., corresponding with the formula  $\text{Cu}_2\text{SO}_5$ . The form of the oblique crystals also agrees with the dolerophanite formed during the Vesuvian eruption of 1868. There is a perfect cleavage parallel to  $\{001\}$ , and the optic axes lie in the plane of symmetry. Dolerophanite is not isomorphous with lanarkite ( $\text{Pb}_2\text{SO}_5$ ).

L. J. S.

Alunite-Jarosite Group of Minerals. By WILLIAM F. HILLEBRAND and SAMUEL L. PENFIELD (*Amer. J. Sci.*, 1902, [iv], 14, 211—220; and *Zeit. Kryst. Min.*, 1902, 36, 545—554).—*Natrojarosite*.—A yellowish-brown, glistening powder from the Soda Springs Valley, Nevada, consisting wholly of minute, perfectly developed rhombohedra with large basal planes, gave, on analysis, the following results (I by Hillebrand). About 6 per cent. of impurities (mainly ferric hydroxide, also  $\text{As}_2\text{O}_5$ , 0.20;  $\text{SiO}_2$ , 0.23;  $\text{CaO}$ , 0.04) were present in the material analysed. Under the microscope, the crystals are golden-yellow by transmitted light; they are optically



uniaxial and negative. Similar material, but rather more compact and schistose in character, from Cook's Peak, New Mexico, gave the partial results under II. A mineral from South Dakota, corresponding to natrojarosite, has already been described by Headden in 1893.

*Plumbojarosite*.—This material, from Cook's Peak, New Mexico, is the same in appearance and physical characters as the natrojarosite, but is darker in colour, being dark brown. It gave on analysis the results under III; the impurities present (mainly ferric hydroxide, also  $\text{SiO}_2$ , 0.51;  $\text{CuO}$ , 0.27;  $\text{CaO}$ , 0.05;  $\text{MgO}$ , 0.01) amount to 4.36 per cent.:

	$\text{Fe}_2\text{O}_3$ .	$\text{Al}_2\text{O}_3$ ?	$\text{PbO}$ .	$\text{K}_2\text{O}$ .	$\text{Na}_2\text{O}$ .	$\text{SO}_3$ .	$\text{H}_2\text{O}$ <105°.	$\text{H}_2\text{O}$ >105°.	Total.	Sp. gr.
I.	50.98	—	—	0.35	6.03	30.96	0.12	11.03	99.94	3.18
II.	55.60	—	0.96	0.77	4.49	—	—	—	—	—
III.	42.37	0.10	19.84	0.17	0.21	27.06	0.02	9.54	100.15	3.665

The formulæ and axial ratios of these new minerals are compared in the following table with those of the other minerals of this group. Natroalunite is the name given to the alunite from Colorado, in which  $\text{K}_2\text{O} : \text{Na}_2\text{O} = 4 : 7$  (Abstr., 1891, 1328; 1894, ii, 458):

	Formula.	Axial ratio ( $c'$ ).
Alunite.....	$\text{K}_2[\text{Al}(\text{OH})_2]_6(\text{SO}_4)_4$	1.252
Natroalunite ...	$(\text{Na}, \text{K})_2[\text{Al}(\text{OH})_2]_6(\text{SO}_4)_4$	—
Jarosite .....	$\text{K}_2[\text{Fe}(\text{OH})_2]_6(\text{SO}_4)_4$	1.245
Natrojarosite ...	$\text{Na}_2[\text{Fe}(\text{OH})_2]_6(\text{SO}_4)_4$	1.104
Plumbojarosite .	$\text{Pb}[\text{Fe}(\text{OH})_2]_6(\text{SO}_4)_4$	1.216

This series of minerals affords an illustration of the rarely occurring isomorphism between sodium, potassium and lead, but this is rather to be explained by the mass effect of the complex molecules of which these elements form a part.

L. J. S.

Minerals from German East Africa. By W. BORNHARDT and B. KÜHN (*Zeit. Kryst. Min.*, 1902, 36, 420—422; from *Zur Oberflächengestaltung und Geologie Deutsch-Ostafrikas. Berlin*, 1900).—In this work are given many petrographical details and descriptions of economic and other minerals. Analyses are given of the following. Epsomite, as a silky efflorescence on slate, on the Kokwamdogo stream, a tributary of the Rufiyi on the Pangani-Enge:

$\text{MgO}$ .	$\text{SO}_3$ .	$\text{H}_2\text{O}$ .	Insol. in water.	Total.
15.42	31.12	46.62	6.74	99.89

Garnet from the Namaputa stream, a tributary of the Rovuma; it has been weathered out of gneiss, in which it is embedded as rounded masses up to the size of a fist. Most pieces are of gem quality, being clear and transparent, and in colour columbine-red with a tinge of brownish-red. The following analysis shows it to be almandine rich in magnesia:

$\text{SiO}_2$ .	$\text{Al}_2\text{O}_3$ .	$\text{FeO}$ .	$\text{CaO}$ .	$\text{MgO}$ .	Total.	Sp. gr.
38.87	23.15	20.55	5.58	11.74	99.89	3.875

Titaniferous iron-ore and magnetite from the Uluguru mountains :

TiO <sub>2</sub> .	Fe <sub>2</sub> O <sub>3</sub> , Fe <sub>3</sub> O <sub>4</sub> .	Al <sub>2</sub> O <sub>3</sub> .	CaO.	MgO.	Insol.	Total.
25·31	63·49	—	0·22	0·38	2·15	98·98
1·85	—	65·52	0·16	0·17	30·88	99·27

L. J. S.

Prehnite and other Zeolites in the Granulites of Cala Francese [in the Island of Maddalena (Sardinia)].—By CARLO RIMATORI (*Atti R. Accad. Lincei*, 1902, [v], 11, i, 542—547).—The author has made further investigations on the chabazites occurring in the granulites of Maddalena, the results obtained confirming the close analogy previously observed by him (Abstr., 1900, ii, 735) between the granulites of Maddalena and of Striegau. No fluorine has, however, been found in the former. The following five minerals from the zeolite group have been observed in the granulites of Cala Francese : stilbite, laumontite, two varieties of prehnite (one green and the other nearly white) and scolecite.

T. H. P.

Variety of Ptilolite from the Island of Principe Rodolfo. By LUIGI COLOMBA (*Atti R. Accad. Sci. Torino*, 1901—1902, 37, 553—560).—The author describes a variety of ptilolite found included in a sample of yellowish calcite from the Bay of Teplitz. The mineral occurs in long, flexible, colourless needles, which have a silky lustre, the larger ones being situated parallel to the long axis, and showing in some cases a terminal face perpendicular to the axis. Analysis gave :

SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	CaO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Total.
67·52	10·76	3·31	1·69	1·19	14·43	99·90

corresponding with the formula  $(\text{Ca}, \text{K}_2, \text{Na}_2)\text{Al}_2\text{Si}_{11}\text{O}_{26} + 8\text{H}_2\text{O}$ , the relation, Ca : K<sub>2</sub> : Na<sub>2</sub> having the value 3 : 1 : 1. It will be seen that this sample of ptilolite is remarkable for the large proportion of acid radicles and of water it contains. The optical properties were also studied.

T. H. P.

Mariupolite, an Extreme Member of the Elæolite Syenites. By JÓZEF MOROZEWICZ (*Tsch. Min. Mitth.*, 1902, 21, 238—246).—A complex of elæolite-syenites, varying from very coarse grained through porphyritic to compact in structure, forms, with intimately associated pyroxenites, an intrusive mass between granite and gneisses in the Mariupol district on the coast of the Sea of Azov. The following minerals were isolated from a coarse grained, porphyritic variety of the elæolite-syenites, and separately examined in detail with reference to their optical and other characters. I, Zircon ("auerbachite," compare Abstr., 1899, ii, 673); the pyramidal crystals are seen under the microscope to be much altered, but fresh portions show the ordinary optical characters of zircon; the alteration of the mineral has been accompanied by a loss of some zirconia and an introduction of water. II, Ægirite, as dark green, elongated, prismatic crystals; formula,  $9\text{Na}_2\text{Fe}_2\text{Si}_4\text{O}_{12} + \text{Na}_2\text{Al}_2\text{Si}_4\text{O}_{12} + \frac{1}{3}(\text{Fe}, \text{Ca}, \text{Mg})_4\text{Si}_4\text{O}_{12}$ . III, Lepidomelane, as isolated black scales; formula,  $2\text{R}'_2\text{R}''_2\text{Si}_2\text{O}_8 + \frac{1}{2}\text{R}''_2\text{Si}_2\text{O}_8$ ; the

amounts of manganese oxides and of soda are higher than is usually the case. IV, Nepheline (elæolite), as large, tabular crystals and rounded masses, which are quite fresh and transparent; the formula,  $K_2Na_8Al_{10}Si_{11}O_{42}$ , is the same as that proposed by Thugutt (Abstr., 1895, ii, 358). V, Albite, as white, finely granular, saccharoidal aggregates of prismatic crystals.

	ZrO <sub>2</sub> .	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Fe <sub>2</sub> O <sub>3</sub> .	FeO.	MnO.	CaO.
I.	61·53	36·17	—	1·03	—	—	—
II.	—	51·47	2·29	30·25	1·22	0·29	0·54
III.	—	33·26	11·70	24·60*	8·51	5·04†	—
IV.	—	43·33	33·97	0·30	—	—	0·12
V.	—	67·46	19·18	0·19	—	—	0·08
VI.	1·08	62·53	18·72	3·26	0·34	0·16	0·54

	MgO.	K <sub>2</sub> O.	Na <sub>2</sub> O.	H <sub>2</sub> O.	Total.	Sp. gr.
I.	—	—	—	1·18	99·91	4·2
II.	0·32	trace	13·73	0·79	100·80	3·502
III.	3·00	7·78	2·46	2·50	98·85‡	3·165
IV.	—	5·40	16·07	0·96	100·15	2·625
V.	—	trace	12·07	0·64	99·62	2·622
VI.	0·08	0·79	11·77	0·68	99·95	2·699

\* Fe<sub>2</sub>O<sub>3</sub> + TiO<sub>2</sub>.

† MnO + Mn<sub>2</sub>O<sub>3</sub>.

‡ F undetermined.

Under VI is given the bulk analysis of the rock, which is remarkable in showing such small amounts of bivalent metals and of potassium. In elæolite-syenites, the ratio Na<sub>2</sub>O : K<sub>2</sub>O rarely exceeds 2½, but here, with an absence of potash-felspar, it reaches 24; for this albite-ægirite-syenite the name mariupolite is proposed. Besides the essential constituents mentioned above, the rock contains very small amounts of iron-ores, apatite, fluorite and sphene. The quantitative mineralogical data given below were determined by the following chemical method. By treating the powdered rock with dilute hydrochloric acid, the nepheline and lepidomelane were decomposed, and a determination of the amount of iron in the solution gave the quantity of the latter mineral; the residue of zircon, albite and ægirite, when treated with dilute hydrofluoric and sulphuric acids, left the zircon unattacked, and a determination of the amount of iron in the solution gave the quantity of ægirite.

Albite.	Nepheline.	Ægirite.	Lepidomelane (and iron-ores).	Zircon.	Total.
73·0	14·0	7·6	4·0	1·6	100·2
74·5	12·5	7·6	3·5	2·0	100·1

L. J. S.

**Meteorite from Bacubirito, Mexico.** By HENRY A. WARD (*Proc. Rochester (N.Y.), Acad. Sci.*, 1902, 4, 67—74).—This enormous mass of meteoric iron, although mentioned in 1876, has now for the first time been completely unearthed at Ranchito, near Bacubirito, in the State of Sinaloa. It is irregular in form, measuring about 13 × 6 × 5 feet, and is estimated to weigh 50 tons; this and the recently discovered Anighito iron of Greenland, also estimated to weigh 50 tons, are thus the largest known meteorites. The surface is covered with well-defined pits, and is only slightly weathered. The structure of the iron is octahedral to a very marked degree, and Widmanstätten figures

are shown on an etched surface in a most beautiful manner. Analysis by J. E. Whitfield gave :

Fe.	Ni.	Co.	S.	P.	Si.	Total.	Sp. gr.
88.944	6.979	0.211	0.005	0.154	trace	96.293	7.69

L. J. S.

**Casas Grandes Meteorite.** By WIRT TASSIN (*Proc. U.S. Nat. Mus.*, 1902, 25, 69—74).—The meteoric iron described purports to be the mass mentioned in 1867 as having been found wrapped in cloth in the ancient Mexican ruins of Casas Grandes in the State of Chihuahua. It is a lenticular mass measuring  $97 \times 74 \times 46$  cm., and weighing 1,544,788 grams. Widmanstätten figures are prominent on an etched surface. A bulk analysis of the iron is given under I, but other determinations of the nickel and cobalt (Ni, 5.02 ; Co, 0.30 : Ni, 4.50 ; Co, 0.00) show that the composition varies in different portions. The following minerals were isolated from the mass and analysed separately: II, troilite ; III, schreibersite ; IV, tænite. Graphitic carbon and an undetermined silicate are also present in small amount :

	Fe.	Ni.	Co.	Cu.	S.	C.	P.	Total.	Sp. gr.
I.	95.13	4.38	0.27	trace	—	trace	0.24	100.02	—
II.	63.40	0.20	—	—	36.21	—	—	99.81	4.789
III.	64.69	20.11	—	—	—	—	15.00	99.80	7.123
IV.	82.90	16.64	—	0.04	—	—	0.09	99.77	—

L. J. S.

**Niagara Meteorite.** By H. L. PRESTON (*J. Geol.*, 1902, 10, 518—519).—A small mass of iron weighing 115 grams was found in 1879 near Niagara, Forks Co., North Dakota. The structure is octahedral. Analysis by J. M. Davison gave :

Fe.	Ni.	Co.	Total.	Sp. gr.
92.67	7.37	0.13	100.17	7.12

L. J. S.

**Meteorite Studies.** By OLIVER CUMMINGS FARRINGTON (*Field Columbian Museum, Geol. Ser.*, 1902, 1, 283—315).—*Long Island, Phillips Co., Kansas.*—This is the largest meteoric stone known, the total weight of the several fragments, many of which can be fitted together, being at least 564 kilos. Sp. gr. 3.45. It is traversed by planes resembling joint-planes, which are of pre-terrestrial origin ; and in structure it belongs to the class of crystalline chondrites. The amount of chromite (8.83 per cent.) present is greater than in any other meteorite. The soluble silicates (24.74 per cent., mainly olivine) have the composition under I, the insoluble silicates (47.05 per cent., mainly bronzite and monoclinic pyroxenes) II, and the nickel-iron (3.31 per cent.) III. Other mineralogical constituents are : limonite (10.50), troilite (5.24), schreibersite (0.23), oxides of cobalt and nickel (0.10 per cent.).

	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	Cr <sub>2</sub> O <sub>3</sub> .	FeO.	CoO.	NiO.	CaO.	MgO.	Na <sub>2</sub> O.	K <sub>2</sub> O.
I.	36.88	6.64	1.38	18.62	—	—	0.08	36.40	—	—
II.	56.52	3.07	—	6.05	0.10	1.45	2.94	29.28	0.53	0.06



*Toluca (Los Reyes), Mexico.*—This iron weighing 19·5 kilos., said to have been found at Los Reyes, appears to belong to the Toluca fall. Analysis gave the results under IV.

*Hopewell Mounds, Ross Co., Ohio.*—A small mass of iron weighing 5 ounces was found with human remains in these Indian mounds. The distortion of the Widmanstätten figures suggests that the iron has been heated and hammered. Analysis gave the results under V.

*Tænite from the Kenton Co. Meteorite.*—The decomposition of this iron causes the separation of the mass into octahedral fragments of iron-grey kamacite, and thin elastic plates of tin-white tænite: the latter gave on analysis the results under VI, agreeing with those required for the formula  $\text{Fe}_{13}\text{Ni}_3$ .

	Fe.	Ni.	Co.	Cu.	Mn.	P.	C.	S.	Si.	Insol.	Total.
III.	78·65	20·26	1·09	—	—	—	—	—	—	—	100·00
V.	90·56	7·71	1·07	0·14	trace	0·24	0·01	0·025	0·006	0·09	99·85
V.	95·20	4·64	0·404	0·035	trace	0·07	—	0·13	(Sn, trace)	—	100·48
VI.	80·3	19·6		—	—	—	—	—	—	—	99·9

A description, without chemical analysis, is also given of the meteoric stone of Ness Co., Kansas.

L. J. S.

## Physiological Chemistry.

**Air of Factories and Workshops.** By JOHN S. HALDANE (*J. Hygiene*, 1902, 2, 414—445).—A paper giving numerous results of analysis; the methods used are described in full. Among interesting points brought out are the small vitiation of the air produced when incandescent gas mantles are used, as compared with any other form of gas burner, and the advantages of the fan method of ventilation.

W. D. H.

**Influence of Altitude on the Composition of the Blood.** By EMIL ABDERHALDEN (*Zeit. Biol.*, 1902, 43, 443—489. Compare this vol., ii, 619).—Numerous analytical data support the author's previous conclusion on the influence of the altitude on the composition of the blood. The principal new point brought out is an increase in the proteids of the serum with an elevated altitude.

W. D. H.

**Affinity of Hæmoglobin for Carbon Monoxide and Oxygen.** By GUSTAV HÜFNER (*Chem. Centr.*, 1902, ii, 459—460. From *Arch. exp. Path. Pharm.*, 48, 87—99).—At 37·5°, the relation of the reaction constant of oxygen ( $k$ ) and of carbon monoxide ( $k'$ ) towards hæmoglobin,  $x = k/k' = 0·00501$ . From this number, it is possible to estimate in any given mixture of the two gases the relative amounts of hæmoglobin with which each combines.

W. D. H.

**Action of Viper Venom on the Blood of the Dog and Rabbit.** By C. PHISALIX (*Compt. rend. Soc. biol.*, 1902, 54, 1067—1070, 1070—1071).—The action of viper venom on rabbit's blood *in vitro* is rapidly to destroy the leucocytes and promote coagulation; the red corpuscles are only slowly disintegrated, owing probably to an excess of anti-hæmolysin. The action on dog's blood is rapidly to destroy the red corpuscles, to change the hæmoglobin into methæmoglobin, and to hinder coagulation due to the liberation of anti-coagulating substances from the corpuscles. Probably here there is an excess of 'sensibiliser' which favours hæmolysis. W. D. H.

**Bactericidal Effects of Human Blood.** By A. E. WRIGHT and F. N. WINDSOR (*J. Hygiene*, 1902, 2, 385—413).—Human serum is bactericidal to the typhoid bacillus and cholera vibrio, but has no such action towards *Staphylococcus pyogenes*, *Bacillus pestis*, or *M. melitensis*. Sterilised cultures of these organisms which are killed by the serum are distinguished from the others by directly abstracting a bactericidal element from the blood. It thus appears that the bactericidal substance must be distinct from the leucocytes which digest all bacteria. Stress is laid on the extreme risk of inoculation in man with even small amounts of the bacilli of plague and Malta fever. W. D. H.

**Disappearance of Ethers Normally Existing in the Blood.** By MAURICE DOYON and ALBERT MOREL (*Compt. rend. Soc. biol.*, 1902, 54, 784—785). **On Lipase.** By M. DOYON and A. MOREL (*ibid.*, 785—787). By MAURICE HANRIOT (*ibid.*, 977—978). **Glycerol in the Blood.** By M. DOYON and A. MOREL (*ibid.*, 1038—1039. Compare Abstr., 1902, ii, 571).—The ethereal extract of blood diminishes if it is kept sterile at 37° without any increase in acidity, glycerol, or soaps. In the absence of oxygen, this does not occur. The next paper is polemical against Hanriot. The latter defends his position in reference to the existence of lipase. In the last paper of the series it is stated that glycerol added to the blood does not disappear, and therefore its absence after the blood has been allowed to remain at 37° is a proof that loss of its fatty matter cannot be explained by saponification.

W. D. H.

**Peptic Digestion.** By E. ZUNZ (*Beitr. chem. Physiol. Path.*, 1902, 2, 435—480).—A large number of analytical tables are given showing quantitatively the relation between the various products of proteolysis when gastric juice is allowed to act on many varieties of pure proteid. The products are distinguished as acid albumin, primary albumoses, deutero-albumoses *A*, *B*, and *C*, true peptone, and other products which do not give the biuret reaction; the nature of these is entered into, and the proportion of aminic nitrogen determined; they are divided into two groups, those which are, and those which are not precipitable by phosphotungstic acid. The albumoses were separated by fractional precipitation with zinc sulphate. A striking feature of the tables is the frequent absence, or presence of only traces, of true peptone.

W. D. H.

**Peptic Digestion of Fibrin.** By ERNST P. PICK (*Beitr. chem. Physiol. Path.*, 1902, 2, 481—513).—The products were separated by their relative solubilities in ammonium sulphate solution and in alcohol, and various albumoses are lettered and numbered. Tables showing the proportion between these and their percentage composition are given. The most notable point appears to be the disappearance of the term deutero-albumose (alluded to as "so-called") and the appearance of two new terms, namely, *glyco-albumose* for the compound prepared from the egg-albumin rich in glucosamine, and *thio-albumose* for that from the serum-albumin rich in sulphur.

W. D. H.

**Trypsin and Erepsin.** By OTTO COHNHEIM (*Zeit. physiol. Chem.*, 1902, 36, 13—19).—Kutscher and Seemann (this vol., ii, 571) minimised the importance of erepsin in digestion. The present paper emphasises its importance.

W. D. H.

**Digestive Enzymes of some Lepidoptera.** By S. SAWAMURA (*Bull. Coll. Agric. Tokyo Imp. Univ.*, 1902, 4, 337—347).—The digestive liquids of the *Lepidoptera*, unlike those of *Vertebrata*, are all alkaline, and it is found that all the enzymes secreted in the digestive canal of silkworms cease to act in presence of acids. The proteolytic enzyme decomposes albumin into peptones; the amylolytic enzyme liquefies starch, with production of dextrin and maltose; whilst the lipatic enzyme, like that of *Vertebrata*, converts fat into fatty acids.

The three enzymes occur in the stomach, but only the proteolytic enzyme is found in the intestines.

Kruckenbergs view, that no part of the intestines of *Invertebrata* is comparable with the stomach of *Vertebrata*, is correct so far as *Lepidoptera* are concerned, since these possess no true gastric juice.

N. H. J. M.

**Rennet and Anti-rennet.** By S. KORSCHUN (*Zeit. physiol. Chem.*, 1902, 36, 141—166).—In horse serum, there is not only a specific anti-rennet, but also a pseudo-anti-rennet which inhibits rennet action, especially at 37°. It is, however, not destroyed by heat, and is easily dialysable.

W. D. H.

**The Proteolytic Action of Venins.** By L. LAUNOY (*Compt. rend.*, 1902, 135, 401—403).—The venom of the cobra, viper, and other snakes acts proteolytically, especially in an alkaline medium, on proteids (of serum and casein); this proceeds as far as the formation of proteoses, not of peptone. This power is removed by filtration through a Chamberland's bougie. The action of pancreatic juice is notably increased by the addition of snake venom (Delezenne's kinase).

W. D. H.

**Comparative Digestibility of Human Milk and its Substitutes.** By FRANCIS W. TUNNICLIFFE (*J. Hygiene*, 1902, 2, 445—451).—The experiments were carried out *in vitro*. They confirm the theory that human casein is chemically different from that of cow's milk. Using either gastric or pancreatic digestion alone, it was found that the

digestibility of the proteid matter of cow's milk and of certain patent milk foods approximates, or even exceeds, that of human casein. When, however, the total digestibility after both gastric and pancreatic digestion is considered, human milk is much more digestible than any other substitute. After 1 hour's peptic and 3 hours' pancreatic digestion, 75 per cent. of the casein is digested; the number for cow's milk is 47, and those for various patent milk foods vary from 35 to 56.

W. D. H.

**Zein as Food.** By W. SZUMOWSKI (*Zeit. physiol. Chem.*, 1902, 36, 198—218).—Dilute alkali converts zein into a modification which is soluble in water. If geese and pigeons are fed on maize, no zein is found in the organs. Introduced into the blood, zein acts as a poison (lowering of blood pressure, &c.) and is found as such in the liver. The urine contains proteid which is not zein. Immunity was not observed.

W. D. H.

**Feeding Experiments on a Dog with various Nitrogenous Materials.** By KARL KORNAUTH (*Bied. Centr.*, 1902, 31, 599—605; from *Zeit. landw. Versuchswes. Oesterr.*, 1900, 3, 1).—The various substances were made into cakes with wheat meal, and were given with small quantities of dog's biscuit alternately with meat meal, with which they were compared. Both food and excrement were analysed. "Aleuronat," which is a product of wheat starch manufacture, was found to have a high feeding value. Conglutin was inferior to both "aleuronat" and meat meal. Casein gave essentially the same results as meat meal, at any rate as regards nitrogen. Gelatin contributed relatively less nitrogen, but had a marked economising effect. Nuclein, from egg-albumin, was found to be less digestible; owing to its acidity, sugar had to be substituted for a portion of the wheat meal.

N. H. J. M.

**Behaviour of Phosphorus in Feeding.** By KARL KORNAUTH (*Bied. Centr.*, 1902, 31, 605—606; from *Zeit. landw. Versuchswes. Oesterr.*, 1900, 3, 133).—In agreement with results obtained by Bischof in 1867, it was found that when the organism is in equilibrium the faeces and urine contain the same amount of phosphorus as that of the food consumed. The author's results also confirm Marcuse's conclusion as regards the completeness of the utilisation in the intestinal canal of the phosphorus in casein, and that with a deposition of the nitrogen of casein there is coincidentally a deposition of phosphorus. In opposition to Marcuse, it was found that the phosphorus of casein is not more completely utilised than that of the other materials, even Liebermann's nuclein, but this may be due to the different experimental conditions.

N. H. J. M.

**Reactions to Stimuli in Unicellular Organisms. IX. Behaviour of fixed Infusoria.** By HERBERT S. JENNINGS (*Amer. J. Physiol.*, 1902, 8, 23—60).—The nature of the experiments is similar to those previously recorded. The fixed infusoria examined were *Stentor* and *Vorticella*. Chemical stimuli act in the main like mechanical;



to osmotic stimuli, a response is only obtained after plasmolysis is well advanced.  
W. D. H.

**The Action of Inorganic Substances on Protista.** By HUGO GOLDBERGER (*Zeit. Biol.*, 1902, 43, 503—581).—The protoplasm of *Protista* behaves differently to many saline solutions than that of the higher animals, the main difference being that the osmotic pressure has little or no influence. The action is chemical, not physical. Inhibition of activity is related to morphological changes; those produced by OH or H ions are characteristic, and, death by acid or alkali, is sharply distinguished morphologically. Recovery may occur by transference to a harmless solution, but the time this takes depends on the length of previous exposure to the poison. Some reactions are not ionic, thus calcium salts are as a rule poisonous, but calcium nitrate and sulphate are harmless. Pure solutions of sodium chloride are less toxic if mixed with the chlorides of calcium and potassium.  
W. D. H.

**Conservation of Muscular Energy in an Atmosphere of Carbon Dioxide.** By LHOTAK DE LHOTA (*Compt. rend.*, 1902, 135, 348—349).—In frog's muscle-nerve preparations, carbon dioxide accelerates the onset of fatigue by stopping the discharge of its energy; this is regarded as a favourable factor in preserving muscular power.  
W. D. H.

**Action of Alcohol on Muscle.** By FREDERIC S. LEE and WILLIAM SALANT (*Amer. J. Physiol.*, 1902, 8, 61—74).—Pure ethyl alcohol, suitably diluted with distilled water, was injected into the dorsal lymph sac of frogs. One leg was ligatured from the effects of the drug, and used as a control for the other. In medium quantity, the effect is beneficial; the contraction is quickened, and fatigue delayed. This is due to the action of alcohol on the muscle, not on the intramuscular nerves. Beyond a certain dose, the opposite effects are obtained. W. D. H.

**Electrical Conductivity of Animal Tissues.** By G. GALEOTTI (*Zeit. Biol.*, 1902, 43, 289—340).—The electrical conductivity of animal tissues mainly depends on the number of free ions present. On removal from the body, these probably combine with proteids, and so conductivity diminishes. Change of temperature produces a change of conductivity, increase being due to a liberation of ions from the proteid compounds. In muscle, contractibility and conductivity run parallel.  
W. D. H.

**Is the Action of Ions a Function of their Electrical Charge?** By JACQUES LOEB (*Pflüger's Archiv*, 1902, 91, 248—264).—From experiments on muscle, *Medusæ*, and the skin, the conclusion is drawn that the stimulating and inhibitory effects of ions are not functions of their electrical charge.  
W. D. H.

**The Time Law of the Fibrin Ferment.** By ERNST FULD (*Beitr. chem. Physiol. Path.*, 1902, 2, 514—527).—Advantage was taken of Delezenne's observations that bird's blood remains uncoagulated for

many days after removal from the body if it is not allowed to touch the muscular and other tissues, or come into contact with dirty utensils. The plasma was removed by the centrifuge, and a ferment solution prepared by making a saline extract of muscle added to it in varying quantities. Taking coagulation time, it was found that Schutz's law holds except for higher concentrations of the ferment.

W. D. H.

**Lævulose in Human Body-juices.** By CARL NEUBERG and H. STRAUSS (*Zeit. physiol. Chem.*, 1902, 36, 227—238).—In some pathological cases, levulose was identified in urine, serum, and ascitic, and pleural fluids. In other cases it was not found.

W. D. H.

**Comparison of the Organic Liquids of the Crab and Sacculina.** By LOUIS BRUNTZ and JEAN GAUTRELET (*Compt. rend.*, 1902, 135, 349—350).—The saline constituents (sodium chloride and phosphates) of the secretion of the *Sacculina* and the blood of its host the crab are the same in amount. The alkalinity of the sacculina fluid is less than that of crab's blood; this is probably due to its fixation. The excreted fluid contains no free ammonia, xanthine compounds, or alkaloids; it contains lactic acid and methylamine.

W. D. H.

**Some Educts from Horse's Brain.** By ALBRECHT BETHE (*Chem. Centr.*, 1902, ii, 460—461; from *Arch. exp. Path. Pharm.*, 48, 73—86).—By treatment of horse's brain with copper chloride, alkali, acetic acid, chloroform, and alcohol in succession, a number of substances, some in a crystalline state, were obtained; names like phrenin, aminocerebrinic acid-glucoside, &c., are given to these, some of which are stated to be identical with those previously separated out and differently named by Thudichum.

W. D. H.

**Lecithin, Kephalin, and Cerebrin from Brain.** By WALDEMAR KOCH (*Zeit. physiol. Chem.*, 1902, 36, 134—140).—Kephalin was precipitated from an ethereal extract of sheep's brain by alcohol. Its formula is  $C_{42}H_{82}O_{13}NP$ , and it is probably dioxystearylmonomethyl lecithin. It swells and forms an emulsion with water like lecithin. The lecithin separated out yielded choline and fatty acids in such a proportion that probably there was a mixture of three possible lecithins. Cerebrin was obtained in a crystalline condition, and the analytical figures agree very well with those obtained by Thierfelder.

W. D. H.

**Composition of Human Fat.** By HERMANN JAECKLE (*Zeit. physiol. Chem.*, 1902, 36, 53—84).—The fat of human adults consists of the glycerides of oleic, palmitic, and stearic acids. There are mere traces of lower acids. In the first months of life, there is a much higher percentage of the lower fatty acids, and much less oleic acid. No relation between the composition of the fat and the state of nutrition was observed. In fatty tumours, the amount of lecithin is considerable. In pathological conditions, it undergoes great variations, and calcium soaps are formed during conditions of calcification.

W. D. H.

**The Formation of Conjugated Glycuronic Acid in the Liver.** By GUSTAV EMBDEN (*Beitr. chem. Physiol. Path.*, 1902, 2, 591—592).—By perfusing a dog's liver with dog's blood, or a mixture of dog's and ox blood containing phenol, not only is there an increase in the combined sulphuric acid, but also of phenol-glycuronic acid. Details of the method adopted for determining these substances are given.

W. D. H.

**Thyreo-globulin.** By A. OSWALD (*Beitr. chem. Physiol. Path.*, 1902, 2, 545—556. Compare Abstr., 1901, ii, 461).—Thyreo-globulin is the main secretion of the thyroid gland and is contained in the colloidal substance. It may be combined with iodine, or not. The amount of iodo-thyreo-globulin is the main factor in the physiological activity of thyroid preparations.

W. D. H.

**Formation of Glycogen in Ascaris.** By ERNST WEINLAND and ADOLF RITTER (*Zeit. Biol.*, 1902, 43, 490—502).—Dextrose in *Ascaris* is a sure precursor of glycogen. Galactose is possibly a glycogen-sparer, but this is certainly so with lævulose and maltose. Lactose has no effect, probably because *Ascaris* lacks lactase. Negative results follow the use of glycogen and other polysaccharides, whether these be injected into the animal or placed in the water surrounding it.

W. D. H.

**Composition of Milk.** By H. DROOP RICHMOND (*Analyst*, 1902, 37, 240—243).—The average monthly composition of 13,936 samples of milk analysed in 1901 is given. From his work on the proteids of milk, the author concludes that casein and albumin are not decomposition products of one proteid existing in milk. As regards the strength of casein as an acid, it was found, from the amounts of various acids required to curdle milk, that boric, acetic, and lactic acids were stronger than casein, and that the latter is an acid of the same strength as the second hydroxyl of phosphoric acid. Four analyses of human milk are also given. The sugar of human milk appears to differ from lactose, as it had, in these analyses,  $[\alpha]_D^{48.7^\circ}$  for the anhydrous sugar; the cupric reducing power was also slightly less than that of lactose.

W. P. S.

**Composition of Colostrum.** By WALTER F. SUTHERST (*Chem. News*, 1902, 86, 1—2).—Analyses of the first twenty milkings of a cow (which was milked twice a day) have been made with the following results. The sp. gr. (by pycnometer) fell rapidly from an initial value of 1.068 to 1.029 (5th milking). The total dry solids (at 105°) amounted in the first milking to 22.878 per cent., but in the second milking to 16.232 per cent., after which slight variation only was observed. The ash was 1.034 in the first and 0.874 per cent. in the second milking. The fat (by Adams' method) rose from 2.302 in the first to the normal value, 5.102 per cent., in the fifth milking. The amount of lactose was initially 2.742 per cent., and slowly increased to 4.6 per cent. at the eighth milking. At the first milking, the total proteid was 12.236 per cent., at the second 6.976, and then slowly fell to 3.464 at the seventh milking. Of the pro-

teids, casein, globulin, and albumin, the first named is initially 4.858 per cent., and then slowly decreases to the normal amount, 2.2 per cent.; globulin (estimated by precipitating with magnesium sulphate) is at the first milking 5.3206, at the second, 2.048 per cent., and then falls at first rapidly, and then more gradually, to 0.2 per cent.; the albumin shows a similar fall from 1.454 to 0.55 per cent. Equilibrium appears to be reached at the ninth milking.

K. J. P. O.

[Composition of Skimmed Milk.] By FRED BORDAS and SIG. DE RACZKOWSKI (*Compt. rend.*, 1902, 135, 354—355).—The analyses given show that by skimming 98 per cent. of the cream from milk, 69 per cent. of the lecithin in the original milk was also removed.

As milk is often skimmed to the extent of 30 or even 40 per cent. of its cream, and consequently suffers a corresponding loss of lecithin, the authors state that the increasing numbers of deaths from gastrointestinal complaints are to be accounted for by this fact. It is particularly noticeable in towns where the sale of skimmed milk is permitted.

W. P. S.

Human Bile. By A. TSCHERMAK (*Centr. Physiol.*, 1902, 16, 329—330).—Human bile has a slight diastatic and tryptic action. It inhibits peptic, but accelerates pancreatic, proteid digestion. Its action towards pancreatic juice is believed to be similar to that of the enterokinase of intestinal juice.

W. D. H.

Effect of Injection of Micro-organisms on the Sterility of Bile. By E. SCOTT CARMICHAEL (*J. Path. Bact.*, 1902, 8, 276—279).—Injection of pathogenic bacteria into the portal circulation leaves the bile sterile; the organisms cannot pass through hepatic tissue.

W. D. H.

Physiology of Leucocytes. By HENRI STASSANO and F. BILLON (*Compt. rend.*, 1902, 135, 322—325).—The elimination of various useless or poisonous materials is believed to be chiefly due to the fact that they are taken up by leucocytes, which subsequently migrate and so carry them to the exterior; this occurs through the wall of the intestine in the case of mercury, through the skin in the case of arsenic and iodine; through secreting glands, for instance, into milk in the case of several poisons. The further fact that leucocytes yield a substance which acts like Pawlow's enterokinase is also regarded as of great importance.

W. D. H.

Excretion of Boric Acid in Man. By G. SONNTAG (*Chem Centr.*, 1902, ii, 227—228; from *Arb. Kais. Ges. A.*, 19, 110—125).—Experiments on three persons who received doses of 3 grams of boric acid show that 50 per cent. of the drug is excreted in the first 12 hours; the remainder is excreted slowly, and traces are found in the urine even eight days later. Polenske's method of estimation was used.

W. D. H.

The Elimination of Chlorides and Phosphates in Experimental Glycosuria. By RAPHAEL LÉPINE and MALTET (*Compt. rend. Soc. biol.*, 1902, 54, 921, 921—922).—An experiment on a dog is



recorded. Phloridzin was given, and the excretion of sugar was accompanied with a rise in the chlorides and a fall in the phosphoric acid of the urine.

W. D. H.

**Glycocyamine, Glycocyamidine, and Ptomaines in Urines.** By FRANCESCO NICOLA (*Chem. Centr.*, 1902, ii, 296—297; from *Giorn. Farm. Chim.*, 51, 241—250).—Griffiths stated that the urine in cases of infectious disease, especially measles, contains ptomaines; glycocyamidine in particular being identified. The author has failed to confirm any of Griffiths' statements. The chemical properties of glycocyamine and glycocyamidine, which were prepared synthetically, are described. The latter is not toxic.

W. D. H.

**The Oxidation Numbers of the Urine in Acid and Alkaline Solution.** By LADISLAUS NIEMIŁOWICZ and G. GITTELMACHER-WILENKO (*Zeit. physiol. Chem.*, 1902, 36, 167—197).—Fractional oxidation, with the help of indicators, especially indigo-carmin and permanganate in acid, and alizarin with potassium ferricyanide in alkaline solution, yields new methods for determining the reducing power of urine. By this means, the oxidisability of the uric acid group was estimated separately from that due to other substances, which include potassium thiocyanate. The normal values of the oxidation numbers vary in health, and are influenced by age, nutrition, and disease.

W. D. H.

**Action of *Bacillus Coli Communis* on Urine.** By DIARMID NOËL PATON (*J. Path. Bact.*, 1902, 8, 280—281).—There is a form of cystitis associated with the presence of *Bacillus coli communis* in which the urine does not become ammoniacal (Melchior). Inoculation of sterile urine with the bacillus produces no change in the distribution of the nitrogen in urea, ammonia, and non-urea compounds. *B. fluorescens liquefaciens*, on the other hand, rapidly decomposes urea into ammonia, although it does not act on non-urea compounds.

W. D. H.

**Conjugated Glycuronic Acids in Normal Fæces.** By MANFRED BIAL (*Beitr. chem. Physiol. Path.*, 1902, 2, 528—531). By MANFRED BIAL and O. HUBER (*ibid.*, 532—534).—Particles of fæces, and aqueous solutions of their alcoholic extract, give the orcinol reaction for glycuronic acid. Further investigation of fæces showed that conjugated glycuronic acids are really present there. On the administration of menthol with the food, the menthol compound of glycuronic acid was separated.

W. D. H.

**Elimination of Carbon Dioxide in certain Metabolic Disorders.** By JOHN WALKER HALL (*J. Path. Bact.*, 1902, 8, 282—287).—Experiments on man show that pure caffeine causes increased production of carbon dioxide, but the increase varies a good deal in different people. Hypoxanthine and uric acid yield negative results; the effect of caffeine is apparently due to its methyl groups.

W. D. H.

**Kinase in Snake Venom.** By C. DELEZENNE (*Compt. rend.*, 1902, 135, 328—329).—Snake venom, like leucocytic extracts, contains a substance (enzyme) which has the properties of Pawlow's enterokinase. Whether it is of use to the animal in digestion, or is the same substance as the toxin, are questions which still await an answer.

W. D. H.

**Ricin Immunity.** By MARTIN JACOBY (*Beitr. chem. Physiol. Path.*, 1902, 2, 535—544. Compare Abstr., 1901, ii, 673).—By mixing ricin with uncoagulable blood, the plasma obtained by the centrifuge contains a poison, which has no agglutinating action, but kills animals with typical symptoms. Part of the poison, however, is held back by the corpuscles. Antiricin inhibits the action of the poison in the plasma. The serum of animals immunised with the plasma poison neutralises the agglutinating and toxic action of ricin. The plasma poison requires less antiricin to neutralise it than ordinary ricin. Pepsin-ricin only agglutinates slightly, but by its use an immune serum is obtained which counteracts both properties of ricin. The blood corpuscles of a highly immunised goat were still agglutinated by ricin. Ricin probably contains three physiological groups: a toxin toxoid; an agglutinin toxoid; and the complete poison. Anti-substances are probably present in the tissue cells as well as in the blood.

W. D. H.

**Action of Erepsin and Intestinal Juice on Toxins and Abrin.** By NADINE SIEBER and C. SCHUMOFF-SIMONOWSKI (*Zeit. physiol. Chem.*, 1902, 36, 244—256).—Erepsin does not lessen the toxicity of abrin; it thus resembles other enzymes. Tetano-toxin is most strongly acted on by a mixture of trypsin and bile. Gastric juices and oxydases lessen its power somewhat, but erepsin and intestinal juice have practically no effect on it. Diphtheria toxin is energetically destroyed by the trypsin-bile mixture. Trypsin alone has considerable action; gastric juice has a smaller action, and erepsin acts like gastric juice; intestinal juice itself has only a small effect. Oxydases act more powerfully than gastric juice. Numbers illustrative of these facts are given.

W. D. H.

**Anti-paramæcic Serum.** By LEDOUX-LEBARD (*Compt. rend.*, 1902, 135, 298—299).—After five or six injections of cultures of *Paramæcium caudatum* under the skin of the rabbit or guinea-pig, the serum of these animals acquires a toxic action in relation to the organism which is greater than that possessed by it in the normal state. The substance to which this is due is not destroyed by heating at 58—63° for half-an-hour. It is a specific action; the serum kills *P. caudatum*, but not other species of *Paramæcium*.

W. D. H.

**Behaviour of Theophylline in the Dog.** By MARTIN KRÜGER and JULIUS SCHMID (*Zeit. physiol. Chem.*, 1902, 36, 1—12).—If 15.9 grams of sodium theophyllate, corresponding with 12 grams of theophylline, are given to a dog, 2.13 grams are excreted as unchanged theophylline and 1.99 grams as 3-methylxanthine, but no 1-methylxanthine is found.

W. D. H.

**Physiological Action of some Reduced Pyrrole Derivatives (Pyrroline, 1-Methylpyrrolidine).** By FRANCIS W. TUNNICLIFFE and OTTO ROSENHEIM (*Chem. Centr.*, 1902, ii, 390—391; from *Centr. Physiol.*, 16, 93—97).—The physiological action of 1-methylpyrrolidine resembles that of nicotine, and corresponds with the close relationship of its chemical constitution to that of nicotine, atropine, and cocaine.

Pyrrole and derivatives containing the pyrrole ring are characterised by their paralysing action on the peripheral nerves connected with the mechanism of the heart; by the introduction of a side group such as, for instance, the inactive pyridine ring, the pharmacological effect is greatly intensified.

The paper also contains a detailed description of the physiological action of pyrroline hydrochloride, pyrrolidine and 1-methylpyrrolidine hydrochloride and tartrate.

E. W. W.

**Pharmacodynamic Properties of certain Aromatic Semicarbazides.** By AUGUSTE LUMIÈRE, LOUIS LUMIÈRE, and J. CHEVROTTIER (*Compt. rend.*, 1902, 135, 187—188).—Phenylsemicarbazide, bromophenylsemicarbazide, methoxy-, and ethoxy-phenylsemicarbazide, and *m*-benzaminosemicarbazide are endowed with antipyretic properties. When introduced into the stomach or cellular tissue of animals, they produce a lowering of temperature without any other noticeable effects. *m*-Benzaminosemicarbazide is the most suitable of these for antipyretic purposes, on account of its stability, solubility, and ease of preparation. The toxicity of this semicarbazide has been determined, as well as its effect on the circulation, respiration, and nutrition, and its antiseptic and antifermentative actions.

J. McC.

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## Chemistry of Vegetable Physiology and Agriculture.

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**Critical Observations on the Theory of Fermentation. (I).** By ANDREAS RICHTER (*Centr. Bakt. Par.*, II, 1902, 8, 787—796).—An examination of the ratio of carbon dioxide produced to oxygen consumed by yeast during an alcoholic fermentation of sugar in presence of peptone, shows that during the early stages this ratio is about 1, but that it then increases considerably, remains high until all the sugar has been fermented, and again falls, generally to about 0.6. It appears probable that at first the yeast cells simply grow without producing fermentation; zymase is then developed in them and fermentation proceeds to the end, after which the cells again simply make use of the nutriment still present (alcohol or peptone) for purposes of growth. The theory of Iwanowsky (*Diss.*, St. Petersburg, 1894) that alcoholic fermentation is a pathological phenomenon in the nourishment of yeast, brought about as a result of the abnormal composition of the nutrient liquid, is therefore groundless.

A. H.

**Cultivation of Bacillus Lepræ.** By G. VAN HOUTUM (*J. Path. Bact.* 1902, 8, 260—275).—A method of successfully cultivating the bacillus of leprosy is described. The 'sensibiliser' which attaches itself to the bacilli only occurs in leper serum. The susceptibility of the bacilli to the action of leper serum explains the numerous failures to cultivate them.

W. D. H.

**Bacteriology of Soil.** By THEODOR REMY (*Centr. Bakt. Par.*, II, 1902, 8, 657—662, 699—705, 728—735, 761—769).—Four soils of different origins were carefully compared as regards (1) chemical and physical composition; (2) behaviour towards peptone solution (putrefactive power), the percentage of the total nitrogen which could be liberated by magnesia after varying times being estimated; (3) capacity for producing nitrates; (4) capacity for destroying nitrates; (5) power of utilising the nitrogen of albumin, ammonium sulphate, and sodium nitrate in the production of vegetation, and (6) total number of bacteria present at different periods of the growth of vegetation.

As a result, it was found that the putrefactive, nitrate-forming, and nitrate-destroying powers of the soil stood in a very direct relation to the power of the soil to utilise the nitrogen of different types of nitrogenous manures in the production of vegetation. The number of bacteria present, on the other hand, afforded no indication of the degree of fertility of the soil. It was also found that a soil which was of very low fertility could not be greatly improved by the simple inoculation of bacteria of the type which was lacking.

A. H.

**Influence of Varying Amounts of Carbon Dioxide in the Air on the Photosynthetic Process of Leaves and on the Mode of Growth of Plants.** By HORACE T. BROWN and F. ESCOMBE (*Proc. Roy. Soc.*, 1902, 70, 397—413).—Several varieties of plants were grown in ordinary air, containing 3.29 parts of carbon dioxide per 10,000, and in air containing about three and a half times more carbon dioxide (11.47 per 10,000). The effect of the larger amount of carbon dioxide became, in most cases, apparent within a week or ten days and then rapidly increased. There was usually an increased number of internodes and, coincidentally, a shortening of the internodes, so that the height of the plants was not essentially altered. A characteristic result was the development of secondary axes in the axils of the leaves, giving the plants a more bushy appearance. The area of the individual leaves was a good deal reduced, and the leaves were frequently curled inwards, which suggests an attempt on the part of the plant to reduce the excessive absorption of carbon dioxide by diminishing the exposure to light. Under the influence of an increased supply of carbon dioxide, the leaves assumed a darker colour and accumulated much larger amounts of starch than under normal conditions. The most important result was the almost complete inhibition of inflorescence.

Of the various plants experimented on, *Impatiens platypetala* suffered most severely in the earlier stages of growth, losing nearly all its leaves. A second growth of small, very dark green leaves was, however, produced.



Further experiments with air containing 6 per cent. of carbon dioxide gave similar results. N. H. J. M.

**Influence of Carbon Dioxide in the Air on the Form and Internal Structure of Plants.** By J. BRET LAND FARMER and S. E. CHANDLER (*Proc. Roy. Soc.*, 1902, 70, 413—423).—The plants grown in ordinary air and in air containing an excess of carbon dioxide (see preceding abstract) were subjected to further examination, attention being especially directed to the relative dimensions of the internodes, the average relative areas of the leaves, the number of stomata per unit of area of leaf surface, the anatomical differences, and the relative amounts of starch, &c.

Except in the case of *Kalanchoë Welwitschii* there was always an increased accumulation of starch in the leaves and ground parenchyma under the influence of an excess of carbon dioxide. In *Kalanchoë*, the ground cells of the stomata contained more starch than when grown under normal conditions, whilst the amount of tannin was very much reduced. The plants which, under the usual conditions, contain crystals of calcium oxalate, contained less when grown in an excess of carbon dioxide except, perhaps, in the case of fuchsia.

The experiments of E. C. Téodoresco (*Rev. Gen. Bot.*, 1899, 2), which indicated greater luxuriance under the influence of excessive carbon dioxide, differed materially from those described above, none of the plants being grown in normal air, but only in air free from carbon dioxide or in presence of 1·5 to 2 per cent. The air was, moreover, partially dried by means of sulphuric acid, and this might tend to promote transpiration. N. H. J. M.

**Certain Relations of Plant Growth to Ionisation of the Soil.** By AMON B. PLOWMAN (*Amer. J. Sci.*, 1902, 14, 129—132).—A large number of pot and water-culture experiments were made, in which the plants were subjected to the action of electricity. Platinum, or, more usually, carbon electrodes were employed. In the case of the soil experiments, an excessive rise of temperature was avoided by addition of water; in the water-culture experiments, the temperature was kept down by means of cold water round the vessels.

The results indicate that vegetable protoplasm is quickly killed by the conditions existing about the anode, whilst within fairly broad limits it is stimulated by the conditions about the cathode. The effects observed cannot be attributed to the slight chemical changes due to dissociation and the electrical separation of the ions.

N. H. J. M.

**Action of Chloroform Vapour on Resting Seeds.** By B. SCHMID (*Bied. Centr.*, 1902, 31, 646; from *Ber. deut. bot. Ges.*, 1901, 19, 71).—Whilst chloroform vapour acts as a poison on the plasma, the effect on dry seeds depends on the nature of the covering of the seeds. Garden cress was not injured by being kept for two months in air saturated with chloroform vapour, whilst a small portion of the peas and wheat was destroyed in 24 hours. All the seeds, when deprived of their skins, were destroyed in 24 hours. N. H. J. M.

**Protein Grains in Oleaginous Seeds.** By BILLE GRAM (*Landw. Versuchs-Stat.*, 1902, 57, 257—296).—The skins of protein grains were generally found to resist the action of moderately strong aqueous potash. In some cases, when the potash causes the skins to burst, sections boiled in alcohol may be employed. The grains contain a substance soluble in water and in alcohol, and having the properties of cane sugar. *Ricinus* globoids were found to contain succinic acid in addition to the substances detected by Pfeiffer. The globoids of the other seeds examined seem to have the same chemical composition.

The globoids of fennel contain magnesium and calcium phosphate, malate, and succinate, and this probably holds good generally in the case of the proteids of umbelliferous plants.

Crystalloids may occur as crystals or in rounded off forms in single seeds, and they may be accompanied by proteid grains free from crystalloids.

N. H. J. M.

**Ammonium as Direct Source of Nitrogen for Plants.** By P. KOSSOWITSCH (*J. exper. Landw.*, 1901, 635—636).—The plan of the experiments was to grow peas, manured respectively with ammonium sulphate and sodium nitrate, under conditions of sterilisation.

At the conclusion of the experiment, it was found that the sterilisation had not been completely maintained; both the plants and the nutritive solutions were, however, free from nitrates. The results showed that when manured with ammonium sulphate the peas grew as well as in presence of nitrate. The plants developed especially well when ferric hydroxide was substituted for calcium carbonate (compare Mazé, *Ann. Inst. Pasteur*, 1900, 26).

N. H. J. M.

**Formation of Asparagine in the Metabolism of Shoots.** By U. SUZUKI (*Bull. Coll. Agric. Tokyo Imp. Univ.*, 1902, 4, 351—356).—The results of experiments with barley and dry beans showed that whilst in cultivated shoots decomposition of protein takes place in absence as well as in presence of oxygen, there was an increase of asparagine only when oxygen was present. Primary amino-compounds decrease with the production of asparagine.

N. H. J. M.

**Amount of Lime Contained in Phanerogamic Parasites.** By K. ASŌ (*Bull. Coll. Agric. Tokyo Imp. Univ.*, 1902, 4, 287—289).—The ash of *Cuscuta europæa* contains only about 2 per cent. of lime, whilst clover, its host, yields an ash with more than 30 per cent. This, together with Palladius's observation that etiolated leaves of *Vicia faba* contained less lime than green leaves and the fact that seedlings generally require less lime before than after they have chlorophyll, accords with the inference that, not only the nuclei, but also the chlorophyll bodies require lime. In this connection, another non-chlorophyllous plant, *Gastrodia elata*, was investigated.

The dry matter of (1) the above ground and (2) the underground parts contained respectively 5.25 and 3.04 per cent. of ash of the following composition:

	K <sub>2</sub> O.	Na <sub>2</sub> O.	CaO.	MgO.	Fe <sub>2</sub> O <sub>3</sub> .	P <sub>2</sub> O <sub>5</sub> .	SO <sub>3</sub> .	SiO <sub>2</sub> , &c.
1.	44.25	7.22	7.31	6.99	1.81	28.57	3.73	0.12
2.	50.99	13.73	5.08	6.37	2.59	17.24	1.85	2.15

The ratio of lime to magnesia in the above-ground parts of *Gastrodia* is therefore 1:1 as compared with flowering cereals 2:1, and lucerne before flowering 8:1 (compare Church, Trans., 1879, 35, 33; 1880, 37, 1, and 1886, 49, 839). The results lend support to the view that the chlorophyll determines the ratio between lime and magnesia.

N. H. J. M.

**The Colouring Matter and the Sugars of Apricots.** By A. DESMOULIÈRE (*Ann. Chim. anal.*, 1902, 7, 323—324).—Apricots contain chiefly sucrose with a little invert sugar and also a small quantity of free dextrose which seems to become less when the fruit ripens.

The colouring matter is extracted by amyl alcohol from either acid or ammoniacal solution. It is distinguished from coal-tar colours by not dyeing either wool or silk, but it is coloured blue on adding sulphuric acid. Probably it is closely related to carotene. L. DE K.

**Mucilage of the Prickly Pear (*Opuntia vulgaris*).** By V. HARLAY (*J. Pharm. Chim.*, 1902, [vi], 16, 193—198).—The mucilage obtained from the cactus *Opuntia vulgaris* consists for the most part of araban and galactan; its solution is dextrorotatory (+35°), and in its behaviour it more closely resembles the gums than the pectins.

H. R. LE S.

**Amount of Oil in Cotton Seeds of Various Origins cultivated in Central Asia.** By D. TSCHERNEVSKY (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 503—504).—When grown in Central Asia, cotton seeds from America or Egypt contain from 21·19 to 23·46 per cent. of oil, whilst those from Bokhara have only 17·15—17·75 per cent.

T. H. P.

**Oil of the Red Elderberry, *Sambucus Racemosa* var. *Arborescens*.** By H. G. BYERS and PAUL HOPKINS (*J. Amer. Chem. Soc.*, 1902, 24, 771—774).—The oil, extracted from the expressed juice of the berries by ether, is of a light yellow colour, which becomes darker on exposure to light or heat. It has a sp. gr. 0·9072 at 15°, solidifies at -8° and melts at 0°. The oil contains 6·65 per cent. of free acid, calculated as oleic, and yields on hydrolysis 11·4 per cent. of glycerol, which is originally present in the form of palmitin, olein, and linolein (?), with small quantities of caprin, caproin, and caprylin. The unsaponifiable matter amounts to 0·66 per cent. The saponification number is 209·3, the iodine number 81·44, the Helmer number 91·75, and the Reichert-Meissl value 1·54.

T. A. H.

**Composition of the Nuts of *Ginkgo Biloba*.** By U. SUZUKI (*Bull. Coll. Agric. Tokyo Imp. Univ.*, 1902, 4, 357—358).—The dry matter of the nuts freed from shells had the following percentage composition:

Total nitrogen.	Proteid nitrogen.	Crude fat.	Lecithin.	Crude fibre.	Starch.	Sucrose.	Reducing sugar.	Ash.
1·8	1·4	2·6	0·17	1·2	62·4	5·2	1·4	3·0

Cholesterol was not detected. The composition of the pure ash, including carbon dioxide, was as follows :

K <sub>2</sub> O.	Na <sub>2</sub> O.	CaO.	MgO.	Fe <sub>2</sub> O <sub>3</sub> and Al <sub>2</sub> O <sub>3</sub> .	P <sub>2</sub> O <sub>5</sub> .	SO <sub>2</sub> .	SiO <sub>2</sub> .	Cl, &c.
47.3	6.0	2.7	6.3	1.7	26.4	6.0	0.5	trace
N. H. J. M.								

Indian Ipecacuanha. By BENJAMIN H. PAUL and ALFRED J. COWNLEY (*Pharm. J.*, 1902, [iv], 15, 256—257).—A sample of Indian ipecacuanha was found to contain emetine 1.39, cephaeline 0.50, and psychotrine 0.09 per cent.

E. G.

Chemistry of *Solanum Dulcamara*. By FREDERICK DAVIS (*Pharm. J.*, 1902, [iv], 15, 160—161).—An examination of *Solanum dulcamara* has revealed the presence of solanine, solanidine, solanein, and dulcamarin. The ripe fruit also contains 0.3—0.7 per cent. of malic acid. Solanine (m. p. 235°), solanidine (m. p. 205°), and solanein are represented by the formulæ C<sub>42</sub>H<sub>75</sub>O<sub>13</sub>N, C<sub>41</sub>H<sub>71</sub>O<sub>2</sub>N and C<sub>48</sub>H<sub>78</sub>O<sub>13</sub>N respectively.

E. G.

Variation in the Occurrence of Salicin and Salinigrin in different Willow and Poplar Barks. By HOOPER A. D. JOWETT and CHARLES E. POTTER (*Pharm. J.*, 1902, [iv], 15, 157—159).—In order to determine the species of *Salix* which yields salinigrin (Jowett, *Trans.*, 1900, 77, 707), a large number of species of *Salix* and *Populus* have been examined. Salinigrin was found in one case only, *Salix discolor*, whilst salicin was detected in eight species, but in only two of these was it present in sufficient quantity to be isolated. It was found that the amount of salicin contained in the bark of a willow or poplar depends, not only on the species, but also on the season of the year in which it is collected, the sex of the tree, and possibly other factors.

E. G.

Decomposition of Fodder and Food by Micro-organisms. II. Organisms Destroying Bread. By JOSEF KÖNIG, ALB. SPIECKER-MANN, and J. TILLMANS (*Zeit. Nahr. Genussm.*, 1902, 5, 737—763. Compare Abstr., 1901, ii, 676).—The action on bread of *Bacillus viscosus* I and II and *B. panis viscosus* I Vogel was accompanied by decomposition of carbohydrates and nitrogenous substances, starch being dextrinised. The fat and crude fibre appeared to be little attacked. As the result of the decomposition of the proteids, free ammonia was formed, and the amount of soluble nitrogenous compounds increased. The acidity of the attacked bread also increased, as compared with the original bread. Experiments on starch showed that the bacteria partially converted it into dextrin and sugars. With yeast, the same alterations were noticed as in the case of bread. An investigation was also carried out on the chemical nature of the “ropiness” of the bread which was produced by the bacteria. Estimations were made of the nitrogen, water, ash, pentosans, and other carbohydrates, after separating the substances into two portions, one soluble and the other insoluble in 50 per cent. alcohol. The former contained:



water, 10.30; nitrogen, 1.61; carbohydrates (after 6 hours' inversion with hydrochloric acid), 42.50; pentosans, 3.48; and ash, 5.48 per cent. The insoluble portion contained: water, 4.49; nitrogen, 8.80; carbohydrates (inverted), 16.74; pentosans, 3.83; and ash, 7.78 per cent.

W. P. S.

**Sunflower Cake.** By RICHARD WINDISCH (*Landw. Versuchs-Stat.*, 1902, 57, 305—316. Compare Abstr., 1894, ii, 155).—The materials examined were all of Hungarian origin. The average composition was found to be as follows:

	Water.	Crude protein.	Crude fat.	N-free extract.	Crude fibre.	Crude ash.
Sunflower seeds ...	6.88	15.19	28.79	17.36	28.54	3.20
„ kernels..	4.00	24.93	50.44	12.83	3.14	4.01
„ husks ...	10.09	6.91	7.87	20.84	51.57	2.69
„ cake ...	5.11	35.62	16.77	24.08	11.69	6.84

N. H. J. M.

**Mill Refuse of Rye and Wheat.** By FRITZ OTTO (*Bied. Centr.*, 1900, 31, 606—610; from *Inaug. Diss. Göttingen*, 1901).—Analyses of the various products from rye and wheat. Determinations of digestibility were also made.

N. H. J. M.

**Amounts of Potassium and Phosphoric Acid in the Ashes of Leaves of Varieties of Potatoes Rich in Starch.** By JOSEF SEISSL and EMANUEL GROSS (*Chem. Centr.*, 1902, ii, 383—384; from *Zeit. Landw. Versuchswe. Oesterr.*, 5, 862—875).—Potassium applied as kainite increased both the yield of tubers and the amount of starch. Superphosphate alone was injurious, both as regards quantity and yield. When both manures were applied, the injurious effect of superphosphate was diminished but not overcome. In every case there was increased leaf production; the leaves were light coloured and yellowish when phosphoric acid was applied (even when in conjunction with potash), but normal with kainite alone.

The ash of leaves of potatoes rich in starch contained more potassium and phosphoric acid than in the case of potatoes poor in starch. The difference was observed all through the vegetative period, and with different manures. As regards the action of manures on the composition of the leaf ash, only phosphoric acid, and, in some cases, potassium, had any effect.

N. H. J. M.

**Manurial Experiments with Forty per cent. Potassium Salts on Potatoes on Peat Soil.** By BRUNO TACKE (*Bied. Centr.*, 1902, 31, 584—585; from *Flugblatt. Bremen*, Dec., 1900).—Forty per cent. "potassium manure salts" gave better results with potatoes than kainite. In the case of newly cultivated peaty soil, 175 to 150 kilos. of potash may be applied, whilst an application of about 100 kilos. per hectare will suffice for similar soil which has been longer cultivated. The best time for applying the salts for potatoes is towards the end of winter.

N. H. J. M.

**Constituents of Emmenthaler Cheese.** By ERNST WINTERSTEIN and J. THÖNY (*Zeit. physiol. Chem.*, 1902, 36, 28—38. Compare Weidmann, *Land. Jahresbueher*, 1882, 587).—During the process of

ripening of Emmenthaler cheese, the fatty constituents undergo but little change; the chief nitrogenous constituent, paracasein, on the other hand, undergoes complex decompositions resulting in the formation of ammonia, amino-acids, and proteid substances soluble in alcohol (caseoglutin). The chief basic constituents which have so far been identified are histidine, lysine, pentamethylenediamine, tetramethylenediamine, and probably guanidine.

Arginine has not been detected; it is presumably formed, but during the ripening process undergoes decomposition, probably into guanidine and tetramethylenediamine.

In only one cheese, a very old one, has any appreciable amount of tyrosine been found, and then it has a very low dextrorotation.

J. J. S.

**Chemical Methods for Estimating the Fertility of Soils as regards Phosphoric Acid.** By K. K. GEDROIZ (*Jour. exper. Landw.*, 1901, 768—769).—Determinations of the phosphoric acid in soils were made by Maercker's method (action of 300 c.c. of 2 per cent. citric acid on 60 grams of soil for 24 hours), and by Bogdanoff's method (digesting 1 kilo. of soil for 24 hours with 4 litres of 2 per cent. acetic acid). At the same time, pot experiments were made in which various plants were grown in the same soils. The results showed that the different plants took up unequal amounts of phosphoric acid, and that barley and flax assimilated amounts differing considerably from those dissolved by 2 per cent. acetic acid. On the whole, citric acid gave better results than acetic acid. N. H. J. M.

**Solution of Phosphoric Acid in Soil Water.** By G. PATUREL (*Ann. Agron.*, 1902, 28, 385—398).—The total phosphoric acid and the phosphoric acid soluble in water (by extracting 300 grams of soil with 1300 c.c. of water) both before and after addition of superphosphate (0.1 per cent.) was determined in six soils: (1) calcareous clay (from lias), (2) sandy clay, (3) sandy soil (derived from granite), (4) slightly calcareous sand, (5) humous sand, and (6) garden soil. The following results were obtained:

	CaCO <sub>3</sub> . per cent.	P <sub>2</sub> O <sub>5</sub> . per cent.	P <sub>2</sub> O <sub>5</sub> soluble in water (mg. per litre).	
			Unmanured.	With superphosphate.
1.....	12.8	0.717	0.42	2.60
2.....	0.4	0.183	0.09	0.55
3.....	0.5	0.119	0.86	15.03
4.....	3.5	0.171	1.55	4.45
5.....	0.4	0.246	1.84	8.31
6.....	9.6	0.409	2.93	—

The results show that there is no relation between the total and soluble phosphoric acid, and that the proportion of the phosphoric acid applied which is retained by the soil has no connection with the amount of calcium carbonate present. The results obtained with soil (5) are of interest, as this is a typical hemp soil, and hemp has a very short vegetative period and requires plenty of available food. The soil

(3), which gave the highest result, is a vine soil which for years had given very good results when manured with superphosphate. Further experiments were made with the samples of this soil obtained five months after the application of superphosphate. Although there had been much rain since the manure was applied, the aqueous extract obtained after five months contained nearly 10 milligrams of phosphoric acid per litre.

N. H. J. M.

**Action of Potassium Manures on Peat Land.** By ANTON BAUMANN (*Bied. Centr.*, 1902, 31, 585—589; from *Vierteljahrsschr. Bayer. Landw.*, 1901, Heft. 1; and *Arb. deut. landw. Ges.*, Heft. 56).—Potassium carbonate and sulphate are the best potassium manures for potatoes on peat soil, and potassium chloride ( $K_2O = 40-50$  per cent.) is a much better manure than salts containing a low percentage of chlorine, especially kainite. Eight years' manuring with salts containing a high percentage of potassium, without lime or marl, was without injurious effect.

N. H. J. M.

**Influence of different Ratios of Lime and Magnesia on the Development of Plants.** By K. Asō (*Bull. Coll. Agric. Tokyo Imp. Univ.*, 1902, 4, 361—370).—Soy beans require a greater excess of lime over magnesia than is the case with wheat, barley, and onions. The difference is attributed to the greater leaf surface produced in a given time by the beans.

The proper ratio between lime and magnesia is of great practical importance and in liming a soil not only the amount of lime already present, but especially its relation to the magnesia, should be considered. The poisonous effect of magnesia in absence of lime and the influence of the latter on the production of root hairs, already observed by Loew, were confirmed.

N. H. J. M.

**To what extent should a Soil be Limed?** By T. FURATA (*Bull. Coll. Agric. Tokyo Imp. Univ.*, 1902, 4, 371—379).—The most favourable ratios  $CaO/MgO$  for buckwheat, cabbage, and oats were found to be 3:1, 2:1, and 1:1 respectively. Before liming a soil, the readily available lime and magnesia should be determined, after which lime should be added in such quantity as will give the desired ratio, according to the kind of crop to be grown.

N. H. J. M.

**Lime Factor for different Crops.** By OSCAR LOEW (*Bull. Coll. Agric. Tokyo Imp. Univ.*, 1902, 4, 381—385. Compare preceding abstracts and Loew and May, this vol., ii, 622).—In reference to the importance of lime to cereals, especially before the flowering period, it is suggested that the application of a very dilute solution of calcium nitrate to the young plants might be very beneficial.

The injurious effects of an excess of magnesia (even a 0.1 per cent. solution of magnesium nitrate) on nuclei and chlorophyll bodies can be seen with a microscope in the case of filaments of *Spirogyra*.

N. H. J. M.

**Relative Power of Agricultural Plants to Utilise the Phosphoric Acid of Crude Phosphates.** By P. KOSSOWITCH (*J. exper. Landw.*, 1901, 730—733).—Mustard and buck wheat grown

in pots gave as good yields with phosphorite as with basic slag, whilst clover and flax were less able to utilise the phosphoric acid of phosphorite. Winter rye gave very unsatisfactory results with phosphate as compared with basic slag.

N. H. J. M.

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## Analytical Chemistry.

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Filter-paper; a Source of Error in Chemical Analysis. (i) Retention of a Dissolved Substance by Filter-paper and by Cotton; (ii) Unequal Spreading of a Substance in Solution when placed on Filter-paper. By MANSIER (*J. Pharm. Chim.*, 1902, [vi], 16, 60—64; 116—120).—When solutions of solid substances are filtered through filter-paper or cotton, the filtered solution generally contains less of the dissolved substance than it did before filtration, owing to the fact that the filter-paper or cotton absorbs an appreciable amount of the dissolved substance. This is particularly the case with solutions of the alkalis, sulphuric acid, and the salts of the alkaloids. Sodium chloride and certain other salts, however, are not thus absorbed.

When a drop of the solution of a solid substance is placed on filter-paper, the outer zone of the moistened portion is very often entirely free from the dissolved substance. These facts may, in the author's opinion, lead to serious errors in chemical analysis.

H. R. LE S.

Titration with Phenolphthalein in Alcoholic Solution. By ROBERT HIRSCH (*Ber.*, 1902, 35, 2874—2877).—One hundred c.c. of neutral 96 per cent. alcohol, containing 5 mg. of phenolphthalein, is coloured only a pale rose by 0.1 c.c. of *N* sodium hydroxide, whereas in aqueous solution an intense colour is developed. On heating the aqueous solution, the colour fades, but that of the alcoholic solution becomes much deeper. In methyl alcoholic solution under similar conditions, no colour appears. Warm solutions of normal sodium acetate and stearate in alcohol give a strong coloration with phenolphthalein; consequently the reddening of an alcoholic solution of soap by phenolphthalein cannot be used alone as an indication of the presence of free alkali.

K. J. P. O.

Preparation of Standard Solutions of Sulphuric Acid by Electrolysis. By DAUVÉ (*J. Pharm. Chim.*, 1902, [vi], 16, 65—66).—The strength of a solution of sulphuric acid, produced by the electrolysis of a neutral solution of copper sulphate, cannot be determined by weighing the copper deposited on the cathode, because cuprous oxide is invariably deposited along with the metallic copper (compare Hart and Croasdale, *J. anal. Chem.*, 1890, 4, 424).

H. R. LE S.



**Volumetric Estimation of Soluble Iodides.** By E. RICHARD (*J. Pharm. Chim.*, 1902, [vi], 16, 207—209).—Ten c.c. of a 1 per cent. solution of the iodide to be estimated are mixed with 10 c.c. of a 0.5 per cent. solution of potassium iodate and 10 c.c. of a 4 per cent. solution of tartaric acid. The mixture is shaken and immediately treated with 20 c.c. of a 10 per cent. solution of disodium hydrogen phosphate, and the free iodine titrated by means of a standard solution of sodium thiosulphate. Tartaric acid is used in preference to all other acids because it has no action on chlorides or bromides in the cold. The sodium phosphate neutralises the free tartaric acid with production of sodium tartrate and sodium dihydrogen phosphate.

H. R. LE S.

**Detection of Iodine and Bromine in the Presence of Thio-sulphates.** By AUGUSTE F. LEUBA (*Ann. Chim. anal.*, 1902, 7, 298—299).—The boiling solution is mixed with a slight excess of lead nitrate which after a few minutes precipitates the thiosulphate. Although the greater part of the iodine is also precipitated, sufficient is left in the filtrate to apply the ordinary tests for iodine; the same process also applies to the detection of bromine. Bromine, however, is best detected by adding to the solution a little sodium hydroxide and a little fluorescein, which causes an intensely red coloration.

L. DE K.

**Improved Reactions and Methods of Preparation of Ozone; Ursol D as a Reagent for Ozone.** By CARL ARNOLD and CURT MENTZEL (*Ber.*, 1902, 35, 2902—2907. Compare this vol., ii, 352).—The violet reaction given by test papers of tetramethyldi-*p*-aminophenylmethane with ozone (*loc. cit.*) is shown to be obtained only when the ozone is quite free from acids. Traces of the latter produce a blue or bluish-green reaction. Thus ozone, prepared from barium peroxide containing nitrite, or from persulphates or sodium peroxide and sulphuric acid, gives a blue reaction, unless previously washed with alkali, or the test papers moistened with a solution of a weak base, ammonia, &c. Ozone is best recognised in aqueous solution by adding one or two drops of a methyl alcoholic solution of tetramethyldi-*p*-aminophenylmethane and 1—2 c.c. of an aqueous solution of silver nitrate or manganous sulphate. In the presence of minute traces of permanganate or cerium sulphate, which give a similar colour reaction with the test, it is necessary to add a saturated solution of ferrous sulphate before addition of the reagent. With river or well water, manganous sulphate is preferable to silver nitrate. Hydrogen peroxide can be recognised in the presence of ozone by means of a solution of benzidine and copper sulphate, which gives a blue precipitate with hydrogen peroxide, but only a reddish-yellow precipitate with ozone. It has been demonstrated by this means that, in neutral solution, ozone and hydrogen peroxide have no action on one another.

Details are given of the best methods of preparing ozone by the action of the dark electric discharge, or of phosphorus on oxygen, and by that of concentrated sulphuric acid on permanganate, persulphate, or barium or hydrogen peroxide.

It is shown that "ursol D," the reagent recommended by Chlopin (this vol., ii, 582) for detecting ozone, only gives a blue coloration in the presence of acids. Pure ozone gives a transient, pale blue coloration, rapidly becoming yellowish-brown. K. J. P. O.

**Estimation of Sulphur in Coal and Pyrites.** By A. REITLINGER (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 457—461).—The author gives a modification of Antony and Lucchesi's method (Abstr., 1899, ii, 517) for estimating the sulphur in coal and pyrites which can be carried out in a comparatively short space of time. 0.5 Gram of the finely powdered coal is intimately mixed with 1 gram of manganese dioxide, 0.5 gram of potassium carbonate, and 0.5 gram of magnesium oxide, and the mixture heated in an inclined platinum crucible by means of a gradually increasing flame. After a quarter to a half hour's heating, the crucible is allowed to cool and then with its contents placed in a beaker of hot water to which is added 10 c.c. of concentrated hydrochloric acid; the beaker is next heated until the mass dissolves, the liquid being then neutralised with ammonia solution to precipitate the ferric hydroxide which is removed by filtering. Experiments made by the author show that by this means the silica is completely precipitated without requiring the long evaporation with hydrochloric acid. The liquid is finally heated to boiling and the sulphuric acid precipitated by means of barium chloride. The process may be still further shortened by using for the oxidation of 0.5 gram of coal, a mixture of 1.5 grams of magnesium oxide, and 1.5 grams of manganese dioxide.

The estimation of sulphur in pyrites is carried out in a similar way, a mixture of 2 grams of manganese dioxide, 1 gram of potassium carbonate, and 1 gram of magnesium oxide being employed with 0.5 gram of the mineral.

A series of parallel estimations shows that the method gives results practically identical with those obtained by the use of the much slower process of Eschka (*Chem. Zeit.*, 1892, 16, 1070). T. H. P.

**A Volumetric Method for the Estimation of Sulphuric Acid in Soluble Sulphates.** By YASUJURO NIKAIIDO (*J. Amer. Chem. Soc.*, 1902, 24, 774—778).—The method is based on the precipitation of the sulphate in alcoholic solution (60 per cent.) by  $N/10$  lead nitrate solution, using potassium iodide as indicator, the yellow colour of the lead iodide becoming visible only when all the sulphuric acid has been precipitated. Free nitric or hydrochloric acid, sodium acetate or large quantities of chlorides, must not be present in the solution. In the case of the sulphates of the heavy metals (iron, zinc, &c.), a little acetic acid should be added to prevent the formation of basic sulphates. The titration must be carried out in the cold.

W. P. S.

**Estimation of Sulphuric Acid in Soils.** By C. B. WILLIAMS (*J. Amer. Chem. Soc.*, 1902, 24, 658—661).—In order to obtain trustworthy estimations of sulphur in pyrites, Lunge has found it necessary to remove the iron by means of excess of ammonia before

precipitating with barium chloride. The author now recommends the removal of the iron and alumina in solutions obtained from ferruginous soils before the estimation of the sulphates is attempted.

L. DE K.

**Quantitative Separations by Persulphates in Acid Solution.** By MAX DITTRICH and C. HASSEL (*Ber.*, 1902, 35, 3266—3271).—Manganese is completely precipitated from a slightly acid (sulphuric or nitric acid) solution by boiling with ammonium persulphate. The precipitate settles well and can easily be filtered. Ammonium persulphate is better than potassium persulphate because it decomposes more easily. Results are given which show that the method works well for the separation of manganese from magnesium, zinc, or aluminium.

The evaluation of persulphate is best carried out by heating with manganese sulphate and hydrochloric acid, conducting the chlorine evolved into potassium iodide solution, and then determining the amount of iodine separated.

J. McC.

**Volumetric Estimation of Selenium.** By K. FRIEDRICH (*Zeit. angew. Chem.*, 1902, 15, 852—856).—The selenium precipitate obtained in the usual course is returned with the filter to the beaker and boiled with 10 c.c. of ammonia and 25 c.c. (or more) of *N*/10 silver nitrate. Black silver selenide is formed and sometimes a white deposit of silver selenite is obtained which, however, redissolves on adding more ammonia. When cold, the liquid is acidified with dilute nitric acid (31.5 grams per litre) until any precipitate of silver selenite has redissolved and the excess of silver is then estimated by Volhard's thiocyanate method. One c.c. of *N*/10 silver represents 0.005914 gram of selenium. The method becomes less accurate when the amount of selenium exceeds 0.05 gram.

L. DE K.

**Behaviour of Selenious Acid in the Marsh Apparatus.** By IWAN SCHINDELMEISER (*Zeit. öffentl. Chem.*, 1902, 8, 306—309).—On adding 0.025 gram of selenious acid to the flask of a Marsh apparatus, the evolution of hydrogen practically ceased, the pieces of zinc being coated with a brown film and a flocculent, brown-red precipitate appearing in the acid solution. This precipitate was found to be a selenium-zinc compound containing from 11 to 19 per cent. of zinc. When aluminium and sodium hydroxide solutions were employed, selenious acid also caused the evolution of hydrogen to cease after a time. In none of the experiments was a mirror obtained. Selenious acid and arsenious oxide were then introduced together into a Marsh apparatus. So long as selenious acid remained in solution no arsenical mirror formed, but when the selenium had separated as a precipitate, the arsenic came over, no trace remaining in the precipitate.

W. P. S.

**Comparative Estimations of Nitrogen by the Method of the Association [of Agricultural Experiment Stations] and the Gunning-Atterberg Modification of Kjeldahl's Method.** By OSCAR KELLNER (*Landw. Versuchs-Stat.*, 1902, 57, 297—304).—The method adopted by

the Association of German Agricultural Experiment Stations consists in heating the substance for three hours with sulphuric acid, containing 200 grams of phosphoric oxide per litre, and about a gram of mercury. In the Gunning-Atterberg modification, the substance (1—2 grams) is heated for about 15 minutes with sulphuric acid (20 c.c.) and mercury (about 1 gram). Potassium sulphate (15—18 grams) is then added, and the mixture boiled for about 15 minutes after it has become colourless. The potassium sulphate may be added at the commencement in the case of substances which do not froth.

The results of a considerable number of determinations, made at Bonn, Danzig, and Hohenheim, showed that the two methods are equally trustworthy, the difference in both cases being less than 0.1 per cent. of nitrogen in 95 per cent. of the analyses.

Both potassium sulphate and phosphoric oxide quickened the decomposition, and potassium sulphate had the advantage that it does not attack the glass. In one case, it was found that the potassium sulphate contained nitrogen (0.001662 per cent.). N. H. J. M.

**Estimation of Nitric Acid in Water.** By RUDOLF Woy (*Zeit. öffentl. Chem.*, 1902, 8, 301—304).—The following modification of Devada's method is described. Five hundred c.c. of the water are boiled in a round-bottomed flask of 800 c.c. capacity until the volume is reduced to 100 c.c. After cooling the contents of the flask to about 50°, 1 gram of an alloy, consisting of aluminium, 59 parts, copper, 39 parts, and zinc, 2 parts, is added together with 5 c.c. of alcohol and 50 c.c. of sodium hydroxide solution (about 280 grams per litre). The flask is then connected to a condenser, a bulb apparatus being placed between the two to prevent splashing over; the lower end of the condenser dips into a measured volume of standard acid. The contents of the flask are kept moderately warm for at least 30 minutes, and then distilled, 100 c.c. of distillate being collected. The excess of acid is titrated, using congo-red as indicator, and the number of c.c. of  $N/10$  acid neutralised by the ammonia multiplied by 10.4, gives the milligrams of  $N_2O_5$  per litre. The acid should be standardised by distilling a known weight of ammonium chloride under the above conditions, and a blank distillation with distilled water and the sodium hydroxide should be made to correct for any ammonia contained in the latter. W. P. S.

**Detection of very small Quantities of Arsenic.** By GABRIEL BERTRAND (*Bull. Soc. Chim.*, 1902, [iii], 27, 851—854).—The author describes the precautions which must be observed in order to detect very small amounts of arsenic (1/1000—1/2000 mg.) in Marsh's apparatus. Small volumes of liquid are employed, the apparatus is first freed from air by passing a current of carbon dioxide, and the tube on which the arsenic deposit is to be obtained is of very small bore. A. F.

**Estimation of Minute Quantities of Arsenic.** By CARL TH. MÖRNER (*Zeit. anal. Chem.*, 1902, 41, 397—413).—Arsenic in quantity amounting to only a fraction of a milligram can be accurately



estimated in such substances as wall-papers, fabrics, glucose, &c., by the following process. The substance is distilled with fuming hydrochloric acid, the distillate received in dilute nitric acid and the solution evaporated to dryness. For the destruction of the organic matter, which is invariably present in this distillate, the residue, while being warmed on the water-bath, is treated with 2 c.c. of 5 per cent. potassium hydroxide (for 1 minute), 2 c.c. of 5 per cent. potassium permanganate (3 minutes), 2 c.c. of 5 per cent. sulphuric acid (3 minutes), and then with 1 c.c. of 20 per cent. tartaric acid, and warmed until colourless. The solution is then filtered, again heated, and mixed with 1 c.c. of a 5 per cent. solution of thioacetic acid. This precipitates the arsenic as trisulphide. After cooling, the precipitate is collected on a 4 cm. filter of the best filter paper and washed five times with 2 c.c. of 0.5 per cent. sulphuric acid, and three times with 2 c.c. of distilled water. The precipitate is then dissolved by pouring into the filter 2 c.c. of 0.5 per cent. potassium hydroxide solution (repeated three times), and the solution received in a flask containing 25 c.c. of *N*/100 permanganate. Oxidation to arsenic and sulphuric acids takes place instantly; the liquid is acidified with 5 c.c. of 5 per cent. sulphuric acid; a quantity of *N*/100 oxalic acid equivalent to the permanganate is added and when the precipitated manganese peroxide has been dissolved by warming, the residual oxalic acid is titrated with *N*/100 permanganate. A small correction (about 0.3 c.c.) is required for organic matter dissolved by the potassium hydroxide from the filter paper and is best estimated by making a blank experiment. In 40 test estimations with materials of the most varied character to which 0.25 mg. of arsenic was added, the result never differed by more than 0.05 mg., and in 29 of them by not more than 0.02 mg. from the quantity taken. One c.c. of *N*/100 permanganate is equivalent to 0.0536 mg. of arsenic in the form of  $\text{As}_2\text{S}_3$ .

M. J. S.

**Decomposition of Ores containing much Arsenic, Iron and Lead with Sulphuric Acid.** By H. NISSENSON and F. CROROGINO (*Chem. Zeit.*, 1902, 26, 847—849).—Ores containing sulphur and arsenic in combination with iron, lead, copper, antimony, zinc, cobalt, nickel, &c., may be rapidly decomposed by heating the finely powdered sample with strong sulphuric acid in a round-bottomed flask for a time varying from half-an-hour to three hours; the end of the reaction may be readily judged from the appearance of the mass. When cold, hot water is added which dissolves the arsenious acid and the soluble sulphates whilst the residue contains insoluble sulphates such as that of lead and compounds of antimony. The metals are then separated by well-known processes. The great advantage of the sulphuric acid treatment is that no arsenic is lost by volatilisation and also that it is obtained in a form readily precipitable by hydrogen sulphide.

L. DE K.

**Action of Boiling Hydrochloric Acid on Arsenic Acid.** By OTTO HEHNER (*Analyst*, 1902, 27, 268—270).—On distilling pure concentrated hydrochloric acid, to which 0.3 per cent. of arsenic oxide had been added, cork joints being used to connect the distillation

flask and fractionating column to the condenser, arsenic could always be detected in the distillates by the hydrogen sulphide test, even when potassium permanganate had been added before commencing the distillation. Ferric chloride was also found to be reduced in the distillation flask. Using nothing but ground-glass connections, no formation of ferrous salt could be detected, and in the arsenic experiments arsenic could not be discovered in the distillates by hydrogen sulphide. The Marsh-Berzelius test, however, gave plain indications of arsenic. As every precaution had been taken to cleanse the flask and condenser from organic matter, the author considers this reduction to be due to the unavoidable presence of atmospheric dust. To prepare acid free from arsenic, it is better to add a powerful reducing agent, then distil, and only collect the distillates after all the arsenic has come over.

W. P. S.

**Estimation of Boric Acid in Margarine.** By ADOLF BEYTHIEN (*Zeit. Nahr. Genussm.*, 1902, 5, 764—766).—From 50 to 100 grams of margarine are weighed into a wide-necked flask and well shaken with 50 grams of hot water. As soon as partial separation has taken place, the contents of the flask are filtered through a dry filter. The almost clear filtrate is cooled to the ordinary temperature, and a portion (usually 40 c.c. can be obtained) is withdrawn by a pipette and neutralised with *N*/10 sodium hydroxide, using phenolphthalein as indicator. Twenty-five c.c. of glycerol are then added, and the titration completed. The *N*/10 sodium hydroxide should be standardised against a known weight of boric acid.

W. P. S.

**New Method of Organic Analysis.** By PAUL THIBAUT and A. CH. VOURNASOS (*Bull. Soc. Chim.*, 1902, [iii], 27, 895—901).—In principle, the method consists in heating the organic substance, mixed with copper oxide (or copper oxide and lead chromate), in a vessel of cast iron to which the absorption apparatus is attached; a side tube permits of a current of oxygen being passed into the vessel for the completion of the combustion. The authors claim great accuracy and expeditiousness for the method.

A. F.

**Gasometric Method for Alkalimetry.** By E. RIEGLER (*Zeit. anal. Chem.*, 1902, 41, 413—419).—The action of hydrazine sulphate on an iodate takes place according to the equation  $6\text{N}_2\text{H}_4\text{SO}_4 + 4\text{NaIO}_3 = 2\text{Na}_2\text{SO}_4 + 4\text{H}_2\text{SO}_4 + 4\text{HI} + 12\text{H}_2\text{O} + 6\text{N}_2$ , whence 1 c.c. of nitrogen (at 0° and 760 mm.) corresponds with 5.2216 mg. of iodic acid, or with 0.0297 *E* mg. of a base of which *E* is the equivalent. If, therefore, an alkali is accurately neutralised with iodic acid and the product treated with hydrazine sulphate in an azotometer, the alkali can be estimated without the use of a standard acid. The author's indicator, diazonitroaniline, can be used with ammonia as well as with the other alkalis when neutralising.

M. J. S.

**Estimation of Calcium and Magnesium in Water.** By ALBERT GRITNER (*Zeit. angew. Chem.*, 1902, 15, 847—852).—A criticism of Clark's soap test and its modifications by Winkler, Pfeifer and others and also of Wartha's alkalimetric process for the estimation of calcium and magnesium in water.

The author could not obtain satisfactory results with Winkler's process, but thinks that good technical results may be got by a combination of Pfeifer's and Wartha's methods. L. DE K.

**Estimation of Free Anhydrous and Hydrated Lime in Cements.** By GEORGE W. MAYNARD (*Bull. Soc. Chim.*, 1902, [iii], 27, 858—882).—For the purpose of estimating the amount of free lime in cements, the author extracts the cement with pure glycerol, which has the property of dissolving the lime but not the other constituents of the cement. A. F.

**Double Ammonium Phosphates in Analysis.** By MARTHA AUSTIN (*Amer. J. Sci.*, 1902, [iv], 14, 156—158).—Dakin has proposed to substitute ammonium phosphate for microcosmic salt when precipitating zinc or manganese as double ammonium phosphates in the presence of ammonium chloride. The precipitates are first washed with a 1 per cent. solution of ammonium phosphate and then with strong, but not absolute, alcohol.

It appears from the author's investigation that the satisfactory results obtained by Dakin are due to a compensation between the increase caused by the washing with alcohol and a loss due to the slight solubility of the asbestos he has employed. When using suitable anhydrous asbestos, the process as given by the author may be safely used for the estimation of magnesium, manganese, cadmium, and zinc (*Abstr.*, 1900, ii, 49). L. DE K.

**Quantitative Separation of Zinc and Cobalt.** By ARTHUR ROSENHEIM and ERNST HULDSCHINSKY (*Zeit. anorg. Chem.*, 1902, 32, 84—90).—In acetic acid solution, zinc sulphide can be quantitatively precipitated and treated in the ordinary manner; very little cobalt is carried down by the zinc sulphide.

Potassium cobaltinitrite precipitated from acetic acid in presence of zinc is never pure and the two metals cannot be satisfactorily separated by this means. The best separation is effected by precipitating zinc sulphide from a solution of the mixed salts to which potassium cyanide has been added in order to form potassium cobaltcyanide. The separation cannot be carried out by precipitating cobalt peroxide by means of potassium persulphate from an alkaline solution because the precipitate always contains a considerable quantity of zinc hydroxide. J. McC.

**Application of Hydroxylamine and Hydrazine Salts in Qualitative Analysis. A New Separation in the Hydrogen Sulphide Group.** By EMIL KNOEVENAGEL and ERICH EBELER (*Ber.*, 1902, 35, 3055—3067).—On account of the many difficulties of the separation of the metals of group II, the authors have devised methods of separating these metals by means of hydrazine, and hydroxylamine and hydrogen peroxide. In the first process, the precipitated sulphides are dissolved in a mixture of hydrochloric and nitric acids, and, after evaporation of the excess of acid, the solution is diluted and dropped into a mixture of 20 per cent. sodium hydroxide solution and saturated

hydrazine sulphate solution. The mixture is warmed, diluted, then filtered. The precipitate may contain metallic mercury or copper, or the hydroxides of cadmium or bismuth, whilst the filtrate may contain sodium arsenate, sodium antimonate, sodium stannate, or sodium plumbate. A process is given for identifying the metals in the precipitate. In the filtrate, the lead is identified by precipitation with hydrogen sulphide, and the arsenic, antimony, and tin in the usual way.

A second method is to dissolve the sulphides in a mixture of hydrochloric and nitric acids, evaporate to dryness, and after the addition of 3—4 c.c. of nitric acid to pour into concentrated ammonia solution containing hydrogen peroxide. The precipitate obtained may contain lead as peroxide along with bismuth hydroxide and stannic acid, whilst the solution contains copper, cadmium, and mercury as soluble complex ammonium compounds and ammonium arsenate and antimonate. The precipitate is treated with sodium carbonate and a little ammonium sulphide, when the tin passes into solution. From the filtrate, mercury can be separated by a hydrazine or hydroxylamine solution, then, on addition of magnesium chloride, magnesium arsenate is precipitated. Copper is separated as thiocyanate, cadmium as sulphide, by means of ammonium sulphide, and, on acidifying, the antimony is precipitated as sulphide. The authors also describe the necessary modifications when platinum, gold, or molybdenum are present.

J. McC.

**The Lake Superior Fire Assay for Copper.** By GEORGE L. HEATH (*J. Amer. Chem. Soc.*, 1902, 24, 699—708).—The method is only suitable for native copper occurring in veins or bedded deposits, including the milled concentrates from the same, and also any oxides, carbonates, or silicates of copper, if entirely free from sulphur. The carefully taken sample (1000 grains) is mixed with fused sodium carbonate and borax (70 to 200 grains of each) and potassium hydrogen tartrate (300 to 350 grains). To rich ores, some old assay slag is added. The charge is fused in a closed crucible in a pot furnace, the latter being brought to a high temperature before introducing the crucible. The fusion requires about 20 minutes, and it is possible to tell by the eye the purity of the copper button and the waste (usually about 0.25 per cent.) in the slag. This waste is balanced by the presence of about 0.25 per cent. of iron in the button.

W. P. S.

**Estimation of Copper by Potassium Permanganate.** By H. A. GUESS (*J. Amer. Chem. Soc.*, 1902, 24, 708—711).—The following method is stated to be at least as accurate as either the cyanide or iodide method for the estimation of small or fractional percentages of copper in crude ores, tailings, &c. From 1 to 5 grams of the sample are digested with aqua regia, with the addition of a few drops of sulphuric acid. The excess of acid is boiled off and the acid solution diluted and filtered. The filtrate is neutralised with ammonia, rendered just acid by a few drops of hydrochloric acid, and reduced by adding an excess of sodium sulphite. The copper is precipitated by either ammonium or potassium thiocyanate, the solution being then



boiled, and decanted on to a filter (11 cm. in diameter) as soon as the precipitate has settled. After bringing the precipitate on the filter, it is well washed with hot water, the funnel is placed over the original precipitation flask and twice filled with 10 per cent. sodium hydroxide solution; insoluble, yellow cuprous hydroxide remains on the filter, sodium thiocyanate passing through. The filter and precipitate are washed with hot water, and the filtrate, while still warm, is titrated with standardised potassium permanganate solution, after being first made decidedly acid with dilute sulphuric acid. As cuprous thiocyanate is slightly soluble, the permanganate solution should be standardised against pure copper treated as just described, and the small error arising from the action of the filter paper on the hot sodium hydroxide solution corrected for by treating an empty filter under similar conditions and titrating the filtrate.

W. P. S.

**Application of Eschka's Method to Pig Iron.** By JOHN V. R. STEHMAN (*J. Amer. Chem. Soc.*, 1902, 24, 644—649).—The author applies the principle of Eschka's sulphur estimation in coal, &c., to pig iron. Three grams of the powdered sample, of a fineness exceeding 50 mesh, are mixed in a 30 c.c. platinum crucible with 2.5 grams of basic mixture, and the whole is then covered with another 0.5 gram of the mixture. This basic mixture is composed of 2 parts of magnesium oxide and 1 part of dry sodium carbonate, or 4 parts of magnesium oxide, 1 part of sodium carbonate, and 1 part of potassium carbonate; the second mixture offers no advantage over the first. The crucible is then heated, by means of a gasoline lamp, for one hour at a full red heat. When cold, the mass is broken up with a glass rod, placed in a beaker, and extracted with hot water; 15 c.c. of bromine water are added, and the whole is boiled for 15 minutes. To the filtrate, which should be quite clear, 1.5 c.c. of hydrochloric acid are added, and, after boiling off the bromine, the sulphuric acid derived from the sulphur in the iron is then estimated as usual. Any sulphuric acid contained in the reagents should be allowed for.

If ordinary coal gas is used as the source of heat, care must be taken to prevent absorption of sulphurous fumes during the ignition. This is successfully prevented by using an asbestos board 8 inches by 4 inches; in the centre of this board and near the lower edge, a clean hole is cut of a size sufficient to admit the crucible. To the upper edge of this board is hinged, by means of a copper wire, a board of the same length, but 3 inches wide and without any hole. This shield is then placed over the tripod in such a manner that when the crucible is put into place about seven-eighths of its length projects through the board and rests on the platinum triangle. The products of combustion from the gas then pass off above and away from the crucible.

The results agree very well with those obtained by Blair's standard method.

L. DE K.

**Estimation of Iron.** By F. SEILER and A. VERDA (*Chem. Zeit.*, 1902, 26, 803—804).—The authors obtained satisfactory results in the colorimetric estimation of small quantities of iron by means of potassium ferrocyanide or potassium thiocyanate, but found that still

more correct results are got by operating as follows. The solution containing the iron as ferric chloride is diluted to 100 c.c.; of this, 10 c.c. are put into a cylinder, mixed with excess of potassium thiocyanate, and diluted to 50 c.c. Ten c.c. of the mixture are diluted with water until a clear red colour is obtained, and a solution of potassium ferrocyanide (0.97 gram per litre) is then added until the colour of the liquid turns green. Each c.c. of ferrocyanide represents 0.0002 gram of iron. If only traces of iron are present, there is no need for so much dilution.

L. DE K.

**Precipitation of Ammonium Vanadate by Ammonium Chloride.** By FRANK A. GOOCH and R. D. GILBERT (*Amer. J. Sci.*, 1902, [iv], 14, 205—210).—The authors have thought it necessary to make fresh experiments to determine whether ammonium metavanadate is insoluble in a completely saturated solution of ammonium chloride, and have found that in the presence of a little free ammonia such is the case. The precipitate must be washed with a saturated solution of ammonium chloride, and the vanadium may then be estimated in the residue by any appropriate means. Gibbs's process (*Amer. Chem. J.*, 1883, 5, 371), based on the precipitation of vanadium as ammonium vanadate and titration of this with permanganate, may therefore be safely used, or Browning's iodometric process may be employed.

L. DE K.

**Precipitation of Ammonium Vanadate by Ammonium Chloride.** By ARTHUR ROSENHEIM (*Zeit. anorg. Chem.*, 1902, 32, 181—182).—The precipitation of ammonium vanadate by ammonium chloride is satisfactory for pure vanadate solutions, but does not give sufficiently accurate results for the quantitative separation of vanadic and tungstic acids.

J. McC.

**Solubility of the Sulphides of Arsenic, Antimony, and Tin.** By WILLIAM R. LANG and C. M. CARSON (*J. Soc. Chem. Ind.*, 1902, 21, 1018. Compare this vol., ii, 530).—Continuing their experiments, the authors tabulate the solubilities of the sulphides in various strengths of hydrochloric acid under different conditions and temperatures. They find that arsenious sulphide is insoluble in hydrochloric acid of sp. gr. 1.16 if hydrogen sulphide is passed into the mixture to saturation. Antimony trisulphide is soluble in a mixture of hydrochloric acid of sp. gr. 1.16 (50 parts) and water (18 parts), even when the solution is completely saturated with hydrogen sulphide. Stannous sulphide is soluble in hydrochloric acid slightly more dilute than that required to dissolve antimony trisulphide.

To separate arsenious sulphide from antimony and tin sulphides, the mixture should be treated with hydrochloric acid diluted with not more than one-third its volume of water, and then saturated with hydrogen sulphide. Arsenious sulphide remains insoluble, and may be removed from the other two sulphides by filtration and washing with a mixture of hydrochloric acid and water (50:18) or with acid containing hydrogen sulphide.

W. P. S.

**Quantitative Separation of Zirconium and Iron.** By ALEXANDER GUTBIER and G. HÜLLER (*Zeit. anorg. Chem.*, 1902, 32, 92—95).—To the solution containing the iron and zirconium, ammonia is added, and the precipitate of mixed ferric and zirconium hydroxides is filtered off, dried, ignited, and weighed. The mixture of ferric and zirconium oxides is ignited in a current of hydrogen; the ferric oxide is reduced to metallic iron but the zirconium oxide is not affected. From the decrease in weight, the amount of iron present can be calculated. Experimental numbers are given which show that the method is accurate.

The method can also be used to determine iron and aluminium together, since aluminium oxide suffers no reduction when heated in hydrogen. J. McC.

**Estimation of Platinum, Gold, and Silver in Alloys.** By PERCY A. E. RICHARDS (*Analyst*, 1902, 27, 265—268).—The following methods were found to give the most accurate results.

*a. Alloys containing Platinum and Silver only.*—About 0.3 gram of the alloy is heated with 10 c.c. of pure sulphuric acid until all apparent action has ceased. When cold, the acid is decanted into a beaker containing cold water, and the residue of metal again treated with sulphuric acid. After pouring off this acid (adding it to the first), the residue of platinum is washed with water (the washings being added to the silver sulphate solution), transferred to a crucible, dried in the air-bath, and weighed. The platinum retains to some extent its original shape, but has a blistered appearance. The silver in the acid filtrate is estimated by the thiocyanate method.

*b. Alloys containing Gold, Platinum, and Silver.*—The alloy is treated with sulphuric acid as just described, the residue of gold and platinum being washed, dried, and weighed as a check. This residue is then dissolved in nitro-hydrochloric acid, concentrated to a small bulk, and the platinum separated as ammonium platinichloride. The gold in the filtrate is precipitated by ferrous sulphate, washed, dried, and weighed.

*c. Alloys containing Gold, Platinum, Silver, and Tin.*—The silver and tin are separated by the sulphuric acid treatment just described, the silver being afterwards titrated in the acid solution and the tin taken by difference. Fair results are also obtained by heating the alloy in a current of chlorine, the tin chloride being volatilised and estimated by difference. Attempts to collect the tin chloride in water were not successful. W. P. S.

**Estimation of the Reducing Power of Natural Waters.** By LUDWIG W. WINKLER (*Zeit. anal. Chem.*, 1902, 41, 419—426).—To estimate the amount of permanganate reduced by a natural water, the author prefers to boil the water for 10 minutes with strongly alkaline permanganate, partly because the oxidation of the organic matter is more complete in alkaline than in acid solutions, and partly because with acid solutions percussive ebullition is scarcely to be avoided. To prepare the standard permanganate, 50 grams of sodium hydroxide (purified by alcohol) are dissolved in 500 c.c. of water, boiled for a

quarter of an hour, and cooled; 0.8 gram of permanganate is added, and the whole made up to 500 c.c. For use, this solution is diluted five-fold, and standardised with *N*/100 oxalic acid. When 10 c.c. of this solution, mixed with 100 c.c. of purified distilled water, are boiled for 10 minutes, a loss of oxygen equal to 0.175 c.c. takes place. As *N*/100 oxalic acid is employed for estimating the unreduced permanganate, special experiments on the permanence of such a solution were made. When prepared with *N*/10 sulphuric acid instead of with water, *N*/100 oxalic acid loses only 0.3 per cent. of its strength in 6 months.

M. J. S.

**The Significance of Phosphates in Natural Waters.** By A. G. WOODMAN (*J. Amer. Chem. Soc.*, 1902, 24, 735—743).—The conclusion arrived at is that the presence of phosphates in water in any quantity indicates pollution. Analyses of 42 samples of water, including estimations of phosphoric acid, confirm this statement. The amounts of phosphoric acid generally varied with the quantities of nitrates and chlorides, although exceptions were found. Less than 1 part of phosphoric oxide per million is considered to be the limit for unpolluted waters.

W. P. S.

**Fractional Combustion of Hydrogen, Carbon Monoxide, and *iso*Pentane.** By K. W. CHARITSCHKOFF (*J. Russ. Phys. Chem. Soc.*, 1902, 34, 461—465).—The author has carried out a number of experiments with mixtures of hydrogen and *isopentane* and of hydrogen and carbon monoxide, the results obtained showing that Winkler's method of fractional combustion in presence of palladinised asbestos is totally inapplicable to the analysis of natural gas. It is also found that, in presence of palladinised asbestos: (1) Pure hydrogen undergoes complete combustion at 80°, carbon monoxide at about 290°, and *isopentane* at a temperature beyond 315°. (2) Nitrogen and other indifferent gases are without influence on the temperature of combustion of hydrogen. (3) An admixture of carbon monoxide and *isopentane* considerably raises the temperature of combustion of hydrogen. (4) If hydrogen be mixed with an equal volume of *isopentane*, it will burn slowly at 200°, 1.6 to 9.2 per cent. of the *isopentane* also undergoing combustion at the same time. (5) The speed of the reaction in the combustion of *isopentane* is very small, and in order that the gas may be completely burnt it must be drawn many times over the strongly heated asbestos. (6) The above observations regarding *isopentane* also hold for carbon monoxide.

T. H. P.

**Recognition of Aromatic Hydrocarbons.** By EDUARD LIPPMANN and ISIDOR POLLAK (*Monatsh.*, 1902, 23, 670—681).—On addition of concentrated sulphuric acid and a few drops of benzylidene chloride, the following hydrocarbons give characteristic colour reactions: anthracene, malachite-green; naphthalene, rosaniline; benzene, light yellow; toluene, light yellow; phenanthrene, carmine; xylene, orange; triphenylmethane, feeble yellow; diphenylmethane, brick-red; stilbene, blue-green;  $\psi$ -cumene, orange-red; cymene, orange; pyrene, emerald green becoming deep blue; picene, olive-



green, the colour forming slowly; dibenzylanthracene, light green; acenaphthene, intense dark blue; chrysene, light yellow becoming light green, and finally dark olive-green.

Benzene, toluene, xylene,  $\psi$ -cumene, and cymene give the characteristic colour with sulphuric acid alone. G. Y.

**Examination of Alcoholic Liquids for Methyl Alcohol.** By N. SCHOORL (*Zeit. anal. Chem.*, 1902, 41, 426—428).—The author does not agree with Habermann and Oesterreicher that pure methyl alcohol reduces permanganate more rapidly than ethyl alcohol (this vol., ii, 110), but attributes their result to the presence of traces of acetone and other easily oxidisable substances in the methyl alcohol which they employed. The Riche-Bardy and Trillat-Wolf methods are the only trustworthy ones for detecting small quantities of methyl alcohol in ethyl alcohol. M. J. S.

**Presence of Arsenic in Glycerol.** By LÉONCE BARTHE (*J. Pharm. Chim.*, 1902, [vi], 16, 52—55).—Glycerol which is free from arsenic may, on treatment with zinc and hydrochloric acid, evolve a gas which reduces silver nitrate. This test is therefore not a trustworthy one for the detection of arsenic in glycerol. Bougault's method (this vol., ii, 530) is very satisfactory and is applicable to the detection of arsenic in glycerol. H. R. LE S.

**Diagnosis of Pentosuria.** By MANFRED BIAL (*Chem. Centr.*, 1902, ii, 295; from *Deutsch. med. Woch.*, 28, 253—254).—Two or three c.c. of the urine suspected to contain pentose are mixed with 4—5 c.c. of a solution containing 1—1.5 grams of orcinol in 500 c.c. of fuming hydrochloric acid, and then with 25 drops of a 10 per cent. solution of ferric chloride. After heating until bubbles just begin to form, the liquid either at once deposits a green colouring matter or turns green on cooling after 15—20 seconds. The process indicates the presence of pentose, but not that of glycuronic acid. L. DE K.

**Pentoses in Urine.** By ERNST KRAFT (*Chem. Centr.*, 1902, ii, 482—483; *Pharm. Zeit.*, 47, 522).—The author recommends the process used by Bial (see preceding abstract). 0.05 per cent. of pentose may be detected by it. L. DE K.

**Capillary Constants of Sugar Solutions.** By A. DÉMICHEL (*Ann. Chim. anal.*, 1902, 7, 335—337).—A recalculation of the table constructed by the German Committee on Standard Weights for the correction of the specific gravity of sugar solutions owing to the capillary action of the liquid so as to suit the French requirement of knowing the amount of sugar in 100 c.c. and not in 100 grams of the solution. L. DE K.

**The Phenylhydrazine Test for Sugar.** By ALBERT B. LYONS (*Pharm. Rev.*, 1902, 20, 155—158).—A criticism of the various modifications of the phenylhydrazine test for dextrose in urine proposed from time to time.

In some cases, the author thinks it advisable to first remove urates and phosphates. To 8 c.c. of the urine are added 1 c.c. of *N*-barium chloride and a few drops of *N*-potassium hydroxide. After filtering, 0.2 gram of sodium carbonate is added and the liquid boiled and again filtered. To 5 c.c. of the filtrate 2 c.c. of acetic acid are added and the test with phenylhydrazine may then be applied. L. DE K.

**Estimation of Sugar by Fermentation.** By ALBERT B. LYONS (*Pharm. Rev.*, 1902, 20, 104—108).—The saccharine liquid containing from 0.2 to 1.5 grams of sugar is mixed with 2 grams of compressed yeast and introduced into a 50 c.c. fermentation flask which is then quite filled with water. The carbon dioxide is collected in a graduated cylinder, which it enters from above, and to prevent absorption the surface of the water is covered with paraffin oil.

The liquid is allowed to ferment for at least 24 hours at 25—30°. An amount of carbon dioxide equal in volume to the liquid should be added to that collected in the cylinder. If the amount of sugar is very small, the carbon dioxide may practically all remain in solution; in such a case, a known weight of sugar should be added. In accurate analyses, the precise amount of carbon dioxide evolved from a known weight of sugar and the amount retained by the liquid may easily be ascertained by direct experiment. The process is particularly recommended for the estimation of sugar in urine. L. DE K.

**Testing for Mannose.** By FRANCIS H. STORER (*Bull. Bussey Inst.*, 1902, 3, 13—45).—Twenty grams of finely powdered wood are boiled with 200 c.c. of 5 per cent. hydrochloric acid for three hours, filtered, and neutralised with sodium hydroxide solution (1:8). One c.c. of the solution is then treated with 12 drops of a solution obtained by dissolving 0.5 gram of phenylhydrazine hydrochloride in 5 c.c. of water and adding 0.3245 gram of sodium acetate. Or a mixture of phenylhydrazine (1 c.c.), glacial acetic acid (2 c.c.) and water (10 c.c.) may be employed. After two hours, or, if the quantity of hydrazine is small, after being left overnight, the mixture is examined microscopically. Full details respecting the mode of applying the method are given and the behaviour of dextrose towards phenylhydrazine is also described. A number of experiments were made in connection with the lead acetate test.

Mannose was found in the trunk-wood of sugar-maple trees, but not in the wood of the grey birch, poplar, and willow. It occurs in orange-peel (not in the seeds), in the artichoke roots, in horse chesnuts, and in the storage-roots of chicory, dandelion, and asparagus. The seeds of white pine and Norway spruce contain only a small amount of mannose, whilst the wood of these and other pines contains it in considerable quantity. N. H. J. M.

**Analyses of Honey.** By R. RACINE (*Zeit. öffentl. Chem.*, 1902, 8, 281—286).—Thirty-nine analyses are given of samples of pure and adulterated honey. Each analysis includes an estimation of the water (dry solids), total sugars, ash, specific gravity, and polarisation of the sample. The principal adulterants detected were invert sugar,

"starch syrup," molasses, and water. The specific gravity does not always indicate the presence of water in "watered" samples; it is better to estimate the dry solids directly for this purpose.

W. P. S.

**Estimation of Starch in Commercial Starches and Flours.** By E. GIANTURCO (*Rev. intern. Falsific.*, 1902, 15, 97—100).—The starch is first washed with distilled water to remove soluble matters, and is then allowed to dry at the ordinary temperature. About 2.5 grams are then well stirred in a beaker with 150—200 c.c. of water, 15 c.c. of a solution of alum (of such strength that each c.c. corresponds with 0.01 gram of aluminium hydroxide) are added, and the mixture is precipitated with a slight excess of ammonia. The precipitate is collected on a tared filter, thoroughly washed with the least possible quantity of water, dried at 100°, and weighed. From the weight found, the known quantity of aluminium hydroxide present is subtracted, the result being starch.

In the case of flour, about 3 grams are placed in a small china basin and formed into a dough by adding a small quantity of water. The lump of dough is then kneaded under a jet of water until all starch has been removed. The washings containing the starch in suspension are precipitated as above.

W. P. S.

**The Composition and Analysis of Starch Syrups.** By MAX HÖNIG (*Zeit. Nahr. Genussm.*, 1902, 5, 641—653).—Commercial starch syrups contain, besides dextrose, two groups of dextrins. One group consists of erythrodextrin and achroodextrin; these may be separated from starch syrup by precipitation with 87 per cent. alcohol (König's method) and then from each other by fractionation from alcohol. The author separates them from the syrup by treating 100 c.c. of a solution containing not more than 1 per cent of dextrose in a 200 c.c. graduated flask with 50 c.c. of saturated barium hydroxide solution. Sufficient 95 per cent. alcohol is then added to make the volume up to 200 c.c. after cooling and shaking. The dextrins are precipitated whilst the dextrose remains entirely soluble. The other group consists of dextrins which are soluble in alcohol, as are also the barium salts, which remain in solution with the dextrose in the above described method of separation. They may be separated from dextrose by fermentation of the filtrate. A scheme for the analysis of starch syrups is also given, and includes the estimation of: (1) The dry solids, by evaporating 50 c.c. of a solution containing 10 grams of syrup in 500 c.c. of water, and drying the residue under reduced pressure for 4 hours at 100°; (2) ash; (3) the cupric reducing power of a 10 per cent. solution of the syrup, by Soxhlet's method; (4) the cupric reducing power of the solution after the separation of the dextrins; (5) the cupric reducing power of an inverted portion of the original solution; and (6) the cupric reducing power of the inverted filtrate from the dextrin precipitate.

W. P. S.

**Estimation of Formaldehyde.** By A. PFAFF (*Chem. Zeit.*, 1902, 26, 701).—The solution of formaldehyde (containing about 0.4 per

cent.) is digested in a closed flask for one hour with a known volume of solution of hydrazine and the unabsorbed hydrazine is then titrated with *N*/10 sulphuric acid using methyl-orange as indicator; 1 mol. of sulphuric acid neutralises 2 mols. of hydrazine. Two mols. of formaldehyde absorb 1 mol. of hydrazine. The test-analyses agree very well with those obtained with Romyn's iodometric method (*Abstr.*, 1897, ii, 166).  
L. DE K.

**Detection of Hydrogen Cyanide in Presence of Thiocyanic, Hydroferrocyanic, and Hydroferricyanic Acids, and their Salts.** By LOUIS E. PREISS (*Amer. Chem. J.*, 1902, 28, 240—241).—After removal of the heavy metals and alkaline earths by boiling with sodium carbonate, potassium hydroxide and aluminium filings are added to the solution, which is then left until the whole of the ferri-cyanide has been reduced. The solution is now acidified with hydrochloric acid, and excess of mercuric chloride is added in order to precipitate the hydroferrocyanic acid. The filtrate is made alkaline with potassium hydroxide and filtered; the clear solution is boiled with solution of ferrous sulphate, and again filtered. Hydrochloric acid and ferric chloride are added, and the iron thiocyanate is decolorised by means of mercuric chloride whereby the precipitate of Prussian blue is rendered visible.  
E. G.

**Iodometry of Thiocyanic Acid.** By ALFRED THIEL (*Ber.*, 1902, 35, 2766—2768. Compare Rupp and Schied, this vol., ii, 538).—Potassium thiocyanate, dissolved in a cold aqueous solution of sodium hydrogen carbonate, is digested for 4 hours with excess of standard iodine solution in a loosely stoppered bottle. The mixture is then treated with excess of hydrochloric acid, the cyanogen iodide formed in the first reaction being destroyed in the acid solution in accordance with the following equation:  $\text{CNI} + \text{HI} = \text{HCN} + \text{I}_2$ . The product is now titrated with standard thiosulphate solution, employing starch as indicator in the ordinary way. The amount of free iodide destroyed is a measure of the thiocyanate present,  $\text{KCNS} + 3\text{I}_2 + 4\text{H}_2\text{O} = \text{KI} + 5\text{HI} + \text{H}_2\text{SO}_4 + \text{HCN}$ .  
G. T. M.

**Estimation of Uric Acid in Urine.** By ADOLF JOLLES (*Zeit. physiol. Chem.*, 1902, 36, 39—41).—The author states that the unsatisfactory results obtained by Matrai (this vol., ii, 541) were due to his not having followed the method as originally described. W. P. S.

**Estimation of Uric Acid by Jolles's Process.** By ALFRED WOGGINZ (*Chem. Centr.*, 1902, ii, 666—667; from *Oesterr. Chem. Zeit.*, 5, 319—320).—Jolles's process (*Abstr.*, 1900, ii, 450) is recommended. If a somewhat excessive amount of permanganate has been used, the quantity of alkaline hypobromite should be increased by 5 or 10 c.c.  
L. DE K.

**Oxidation and Estimation of Uric Acid and Urates.** By JAMES F. TOCHER (*Pharm. J.*, 1902, [iv], 15, 161—166).—When a dilute solution of uric acid is oxidised with acid permanganate, carb-



amide and alloxan are produced. Alloxan may be readily detected by the deep rose-red coloration produced when it is warmed with dilute ammonia, and which is changed to purple by sodium or potassium hydroxide. The variable results obtained by Hopkins's method of estimating uric acid are mainly due to the presence of alloxan formed during the reaction; if, however, the titration is carried out in a cold, very dilute solution, and the end reaction is taken at the point at which the colour persists for about 15 seconds, the Hopkins factor is trustworthy. Constant results cannot be obtained by boiling the solution of uric acid with excess of alkaline permanganate and titrating back. When uric acid is boiled for 2 minutes with solution of chromic acid, it is completely converted into carbamide and carbon dioxide; in a concentrated solution of chromic acid, however, a small portion of the carbamide may be converted into ammonia. The carbamide produced is estimated by means of hypobromite in a modified Doremus tube.

In the analysis of urine, the uric acid is precipitated as ammonium urate and oxidised with chromic acid as described above. In clinical work, a sample of the urine may be oxidised with chromic acid and the total nitrogen estimated by the hypobromite method, the nitrogen due to the carbamide being estimated in another portion from which the uric acid has been precipitated as barium urate.

An appendix to the paper contains a summary of the various methods for the estimation of uric acid which have been suggested by previous workers.

E. G.

**Estimation of the Acidity of Urine by Calcium Sucrate.** By J. DE GIRARD and J. VIRES (*Bull. Soc. Chim.*, 1902, [iii], 27, 892—895. Compare Joulie, *Abstr.*, 1898, ii, 315).—The author finds that when calcium sucrate is added to a solution of an acid phosphate of an alkali metal, dicalcium phosphate and an alkali phosphate are formed, whilst a portion of the original acid phosphate remains in the solution, which also has an acid reaction. For this reason, calcium sucrate cannot be employed to estimate the acidity of urine.

A. F.

**The Occurrence of Salicylic Acid in Natural Wines.** By KARL WINDISCH (*Zeit. Nahr. Genussm.*, 1902, 5, 653—662).—The author was unable to detect the presence of salicylic acid in grapes of the 1901 vintage in Germany, and comes to the conclusion that it may be present in one year and not in another. That it is sometimes present is proved by the investigations of others (Ferreira da Silva and Mastbaum). The amount which has been found is extremely small, and is not detected by the ordinary method of testing wine for added salicylic acid.

W. P. S.

**Rapid Method for the Analysis of Soaps.** By FERNAND TELLE (*J. Pharm. Chim.*, 1902, [vi], 16, 121—125).—The soap (2 grams) is dissolved in hot water, 10 c.c. of *N*-hydrochloric acid are added, the fatty acids extracted with ether, and weighed. In the aqueous solution, the excess of hydrochloric acid is titrated, and from the result the total alkali deduced. The uncombined alkali hydroxide or carbon-

ate in the soap is estimated by a modification of Divine's method (Abstr., 1900, ii, 759), in which approximately  $N/10$  oleic acid is used in place of stearic acid.

H. R. LE S.

**Estimation of Fat in Milk by means of the Refractometer.** By SIGMUND HALS and HARALD GREGG (*Milch Zeit.*, 1902, 31, 433—436).—Wollny's refractometric method was compared with the Adams process for the estimation of fat in milk. The results of numerous analyses by both methods show that the percentages of fat found by the refractometer in all cases agree very accurately with the amount as determined by the Adams process. Milk, with and without preservatives, which had been kept for from 3 to 5 weeks, gave slightly lower results by the Wollny method, the difference averaging  $-0.06$  per cent. Wollny's method as used in these experiments was as follows: 20 c.c. of milk were shaken with 1 drop of copper chloride solution (238 grams per litre) and 3 drops of glacial acetic acid for 15 minutes at a temperature of  $17.5^{\circ}$ . One c.c. of a solution containing 250 grams of potassium hydroxide, 500 c.c. of water, 250 c.c. of glycerol, and 100 grams of copper carbonate was added, and then 4 c.c. of ether previously saturated with water at  $17.5^{\circ}$ . The mixture was shaken for 15 minutes and subjected to centrifugal action, the refraction of the ethereal fat solution being then determined. Naumann's modification of this method was not found to give accurate results in the case of fresh skimmed milk, where the amount of fat is low, but with sour milk it worked more satisfactorily. W. P. S.

**Analysis of Butter Fat and the Relation between the various Constants of the same.** By PAUL BEHREND and H. WOLFS (*Zeit. Nahr. Genussm.*, 1902, 5, 689—719).—The butters examined were obtained from the milk of separate cows, each butter fat being analysed separately. From the averages of the results obtained it is seen that, to a certain extent, there is a relation between the various analytical values. The Reichert-Meissl numbers of the fats decreased as the melting point rose, and the latter approximately increased in proportion with the amount of insoluble fatty acids. The Reichert-Meissl numbers also diminished as the refractometer values increased. Little relation exists between the refractometer value and the melting point. The iodine values increased with the refractometer readings, the Köttstorfer values at the same time showing a decrease. The Köttstorfer and Reichert-Meissl numbers increased as the iodine values and insoluble acids decreased.

W. P. S.

**The Unsaponifiable Substances in Butter Fat.** By ARTHUR KIRSTEN (*Zeit. Nahr. Genussm.*, 1902, 5, 833—856).—The unsaponifiable matter found in butter fats consists principally of cholesterol, with small quantities of lecithin and yellow colouring substances. The cholesterol is best separated and estimated by Bömer's method; 10 grams of the butter are saponified with an alcoholic solution of potassium hydroxide, and the dilute soap solution thoroughly extracted with ether. After distilling off the latter, the residue is again treated with potassium hydroxide solution and extracted with ether. The

etheral solution is shaken with 5 per cent. potassium hydroxide solution, the latter being afterwards extracted with ether, and the united extracts washed with water and filtered. The final residue from the ether is dried at  $100^{\circ}$  and weighed, the weight giving the amount of "crude" cholesterol in the fat. A number of estimations of the latter are given, the results showing that the quantity varies slightly according to the period of lactation. At the commencement of lactation, the average amount of "crude" cholesterol is 0.375 per cent., rising at the end to 0.50 per cent.

W. P. S.

[Detection of Margarine.] By FRANZ UTZ (*Chem. Zeit.*, 1902, 26, 730—731).—A series of experiments which proves that under certain, as yet unknown, conditions the active principle of sesamé oil may pass into the milk and consequently into the butter prepared therefrom and then cause the Baudouin or Soltsien reactions, which have lately been recommended for the safe detection of margarine in butter. It must be remembered that in some countries margarine always contains an admixture of sesamé oil as prescribed by law.

The quantity introduced seems, however, to be so trifling that the Reichert-Meissl number and the refraction of the butter are not sensibly affected when the cows have been partially fed on sesamé cakes.

L. DE K.

Refractive Indices of Salad Oils—Correction for Temperature. By L. M. TOLMAN and L. S. MUNSON (*J. Amer. Chem. Soc.*, 1902, 24, 754—758).—Using a Zeiss butyro-refractometer, it was found that the correction for change in the refractive index for  $1^{\circ}$  amounted to 0.000365 for ordinary fats and oils (cotton, olive, poppy-seed, sunflower, rape, mustard, black mustard, lard, pea-nut, and sesamé). The change in the refractive index for variation of temperature being more constant than the change in scale divisions, it is better to calculate the scale reading into the refractive index, make the above correction, and recalculate into scale divisions. For corrections of a few degrees, the formula  $R = R' - X(T - T')$  may be employed,  $R$  = reading corrected to  $T'$ ,  $R'$  = reading at  $T$ ,  $T$  = desired temperature,  $T'$  = temperature at which reading was made and  $X$  = change in scale division caused by change of temperature for  $1^{\circ}$ . For butters which read from  $40$ — $50^{\circ}$  on the scale,  $X = 0.55$ ; for oils reading from  $60$ — $70^{\circ}$ , it is 0.58; and from  $70$ — $80^{\circ}$  it is 0.62.

W. P. S.

The Influence of the Growth of Mould on the Chemical Composition of Oleomargarine and Butter. By CHARLES A. CRAMPTON (*J. Amer. Chem. Soc.*, 1902, 24, 711—719).—About 50 samples of margarine, which had been kept in glass-stoppered bottles for 2 years, were re-examined at the end of this time. Many of the samples had become permeated with a growth of dark green mould, a (probably undescribed) species of *Coniothecium*. The refractive indices of the samples varied to a considerable extent, being particularly low in those showing the strongest growth of mould. The mouldy samples also gave much lower Reichert-Meissl figures as compared with a

sample of the original fat which had not become mouldy, and the specific gravities were unusually low.

An analysis of a sample of mouldy butter confirmed the statements of Hanuš and Stocký that the growth of moulds produces a decrease in the Reichert-Meissl figure (Abstr., 1900, ii, 772). The conclusions are that, in the case of edible fats, where the presence of nitrogenous and other non-fatty matters afford a medium for the growth, the greater part of the changes included under the general term "rancidity" is due to the action of micro-organisms or to the enzymes resulting from their development. The results obtained in the experiments with the oleomargarines are explained by the author, his explanations agreeing with those of König, Spieckermann, and Bremer (Abstr., 1901, ii, 676).  
W. P. S.

**Microchemical Analysis of Alkaloids.** By M. EMM. POZZI-ESCOT (*Ann. Chim. anal.*, 1902, 7, 337—338. Compare Abstr., 1901, ii, 485).—A reply to Surre (this vol., ii, 543), who has applied the process previously used by the author.  
L. DE K.

**New Reactions for Quinine and Quinidine.** By EDUARD HIRSCHSOHN (*Chem. Centr.*, 1902, ii, 540; from *Pharm. Centr. Halle*, 43, 367—368).—Neutral solutions of quinine and quinidine hydrochloride or sulphate turn a raspberry-red colour when boiled with a drop of a solution containing 2 per cent. of hydrogen peroxide and 10 per cent. of copper sulphate and thus behave like a solution of aloin. The colour gradually changes to violet-blue and finally to green. In similar circumstances, thalline sulphate or tartrate give an onion-red, kairine an intensive blue, and asparagine a light blue colour. All the other alkaloids, glucosides and bitter substances which have been investigated by the author are not coloured at all or only turn pale yellow or brownish. Free acids and alcohol interfere with the reaction. The test still shows in a dilution of 1 to 10,000. L. DE K.

**Separation of Brucine from Strychnine.** By ALBERT B. LYONS (*Pharm. Rev.*, 1902, 20, 253—255).—The process is intended for the assay of nux vomica extract. The mixed strychnine and brucine obtained in the ordinary way is treated with dilute (10 per cent.) sulphuric acid, U.S.P., using 1 c.c. of acid for every 0.015 gram of the alkaloidal mixture. It was found that in these circumstances 1 c.c. of acid dissolves only 0.00175 gram of strychnine, so that the bulk of this remains as insoluble sulphate, whilst the brucine is practically all dissolved.

After collecting the insoluble matter on a very small filter and washing with a few drops of acid, the strychnine may be recovered by shaking the sulphate with ammonia and chloroform; the latter, on evaporation, yields the fairly pure alkaloid. If it is desired to avoid making a correction for the slight solubility of strychnine, an acid saturated with the alkaloid may be used. This may be prepared by adding to 100 c.c. of a 10 per cent. sulphuric acid 0.275 gram of brucine, and 0.225 gram of strychnine, and filtering after an hour. The addition of brucine is necessary, as it increases the solubility of the strychnine.

L. DE K.



**Assay of Opium.** By A. B. STEVENS (*Pharm. Archiv*, 1902, 5, 41—45. Compare Abstr., 1901, ii, 631).—Four grams of the finely powdered sample are triturated in a mortar with 2 grams of freshly burnt calcium oxide and 10 c.c. of water; another 19 c.c. of water are added, and the whole is frequently stirred for half an hour. Fifteen c.c. of the filtrate are then placed in a 60 c.c. bottle, 4 c.c. of alcohol and 10 c.c. of ether are added, and the whole is well shaken. Half a gram of ammonium chloride is next added, and after shaking for half an hour the whole is set aside in a cold place for 12 hours. The supernatant ether is then poured off into a funnel closed with a plug of absorbent cotton, and the bottle is rinsed with another 10 c.c. of ether. The contents of the bottle are poured into the funnel, and both crystals in the funnel and bottle are washed with water saturated with morphine, until the washings are colourless. The funnel is now placed over the bottle, the cotton lifted with a glass rod drawn out to a curved point, and the crystals are rinsed into the bottle with 12 c.c. of *N*/10 sulphuric acid; the cotton is then also put into the bottle, which is then corked and well shaken. After rinsing both cork and funnel with water the excess of acid is neutralised by *N*/40 potassium hydroxide. The number of c.c. of *N*/10 acid consumed multiplied by 1.5038 gives the percentage of morphine in the sample; to this must be added an extra 1.12 per cent. to compensate for morphine remaining in solution.

L. DE K.

**Evaluation of Ipecacuanha Root.** By GUSTAV FRERICHS and N. DE FUENTES TAPIS (*Arch. Pharm.*, 1902, 240, 390—423).—The authors have analysed the hydrochlorides of emetine and cephaeline, and found the same composition as Paul and Cownley (Abstr., 1896, i, 192; *Amer. J. Pharm.*, 1901, 73, 57, 107); they incline towards the formulæ adopted by the latter. Cephaeline melts at 119° when all the solvent has been driven off from it.

An historical account is given of the various methods proposed for the evaluation of ipecacuanha root, and the methods are examined critically. Preference is given to the following ones, which are slight modifications of those of Keller (Abstr., 1893, ii, 397; 1894, ii, 263). It is thought that a determination of the amount of emetine and cephaeline together is sufficient, as the amount of psychotrine (Paul and Cownley, *Amer. J. Pharm.*, 1901, *loc. cit.*) is relatively very small; moreover, the colour caused by the presence of psychotrine renders impossible a titration of the alkaloids with iodeosin as indicator. The weights of the two alkaloids which combine with 1HCl being respectively 248 and 234, 1 c.c. of 0.1*N* hydrochloric acid may be taken, without serious error, as corresponding with 0.0241 gram of alkaloid. Psychotrine is not dissolved by ether, and even when ether-chloroform is used, it is not dissolved when sodium carbonate has been employed to set free the alkaloids.

**Volumetric.**—Shake 6 grams of the powdered root with 60 grams of ether, add 5 c.c. of ammonia solution (10 per cent. ?) or 5 c.c. of sodium carbonate solution (1 : 3), and shake at intervals during an hour. Add 10 c.c. of water, shake, filter off 50 grams of the ether, concentrate it to half its bulk, and shake it with 10 c.c. of 0.1*N* hydrochloric acid. Filter

the acid, shake the ether twice with 10 c.c. of water, running this wash-water through the same filter into the acid extract, dilute to about 100 c.c., add so much ether that a layer 1 cm. or so deep remains on the surface of the liquid after shaking, then add 5 drops of iodeosin solution (1:250), and titrate with 0.1*N* potassium hydroxide. Multiply the net number of c.c. neutralised by the alkaloid by 0.482; the result is the percentage of alkaloid in the root.

*Gravimetric.*—This method is to be preferred when an evaluation of the drug has to be performed only occasionally. The 50 grams of ethereal solution mentioned above are shaken with 5 c.c. of dilute hydrochloric acid and 10 c.c. of water, and the aqueous extract is removed to another separating funnel; the ether is then extracted twice in succession with 10 c.c. of water, and the extracts are removed to the same funnel. To the acid liquid, 5 c.c. of ammonia solution are added and the mixture is shaken with 50 grams of ether; 40 grams of the ethereal extract are evaporated in a tared flask and the residue dried at 100° and weighed; 25 times this weight gives the percentage of emetine and cephaeline together in the sample. It is possible to check the result by dissolving the residue in 5 c.c. of 0.1*N* hydrochloric acid, adding water, ether, and iodeosin, and titrating back with 0.1*N* potassium hydroxide; the end-point is obscured, however, by a discoloration resulting from the slight decomposition which the alkaloids undergo when dried. A certain assurance against adulteration may be obtained by testing qualitatively for cephaeline; dissolve the residue in Fröhde's reagent, and add a particle of sodium chloride, when dark blue coloration will appear if cephaeline is present.

A determination of the total amount of emetine and cephaeline suffices for most practical purposes. If the separate amounts are required, the determination must be repeated, the cephaeline being removed from the ethereal solution by shaking it three times with about 10 c.c. of aqueous sodium hydroxide, and the residual emetine determined; the cephaeline is determined by difference. To estimate the psychotrine, make a third determination, extracting the alkaloids with ether-chloroform, and subtracting from the total weight of alkaloids so found the weights of emetine and cephaeline. C. F. B.

**Vintage Musts and Liqueur Wines: their Specific Characters and Analysis.** By CARI-MANTRAND (*Bull. Soc. Chim.*, 1902, [iii], 27, 822—829).—To distinguish between the fresh grape juice to which alcohol has been added and true liqueur wines, the author has made a number of analyses, and finds that the weight of dry extract, after subtraction of the reducing sugar, and the acidity of the former are relatively small compared with the corresponding amounts obtained with fermented wines. A. F.

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(Marked A. i and A. ii respectively); and also to Transactions, 1902 (marked T.); and to Proceedings, 1901—1902; Nos. 241 to 258, Nov., 1901—Dec., 1902 (marked P.).

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- Acid amides.** See Amides.
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 Acetic acid.  
 Acetoacetic acid.  
 Acetone- $\beta$ -naphthylcarbamie acid.  
 Acetone- $\alpha\gamma\gamma$ -trisulphonic acid.  
 Acetophenone-phenyl- and -*o*-tolylcarbamie acids.  
 $\alpha$ -Acetoxy- $\gamma$ -phenylcrotonic acid.  
 Acetylcochenillic acid.  
 Acetylhydroxamic acid.  
 Acetyl-*m*-hydroxyphenyl-*p*-tolyl-aminosulphonic acids.  
 Acetylinodoxylic acids.  
 Acetylmethylantranilic acid.  
 $\gamma$ -Acetylmethylbutyric acids.  
 5-Acetyl-4-methylpyrazole-3-carboxylic acid.  
 5-Acetyl-4-methylpyrazoline-3:5-dicarboxylic acid.  
 $\alpha$ -Acetyl- $\gamma$ -phenylacetoacetic acid.  
 $\gamma$ -Acetyl- $\gamma$ -phenylbutyrolactone- $\beta$ -carboxylic acid.  
 $o$ -Acetylphenylcarbamie acid.

**Acids.** See:—

Acetylphenylmalonamic acid.  
 5-Acetyl-4-phenylpyrazoline-3:5-dicarboxylic acid.  
 Acetyl*isopropyl*butyric acid.  
 Acetyl*dithiocarbamic* acid.  
 Aconitic acids.  
 Acylecyanoacetic acids.  
 Acylthiocarbamic acids.  
 Adipic acids.  
 Afelemic acid.  
 Agaric acid.  
 Agaricic acid.  
 Alanine.  
 Alanylalaninecarboxylic acid.  
 $\beta$ -Aldehydic acids.  
 8-Aldehydonaphthoic acid.  
 Alkylmalonic acid.  
 Allophanic acid.  
 Aminoximeoxalic acid.  
*m-iso* Amylaminobenzoic acid.  
*m-iso* Amylaminohexahydrobenzoic acid.  
 Angelic acid.  
 Anhydrobrazilic acid.  
 $\beta$ -Anilinoerotic acid.  
 $\beta$ -Anilino- $\beta$ -cyanobutyric acid.  
 Anilinoethylenetricarboxylic acid.  
 2-Anilinohydrocarbostyryl-2-carboxylic acid.  
 Anilinomalonic acid.  
 Anilinomethylenemalonic acid.  
 2-Anilino-3:5-*d*-nitrobenzoic acid.  
 Anilinophosphamic acid.  
 Anilino-*p*-toluidinophosphoric acid.  
*p*-Anisidinomethylenemalonic acid.  
 Anisolepropionic acid.  
 $\alpha$ -Anisylidenelævulic acid.  
 Anisylidenemalic acid.  
 Anthragallolsulphonic acid.  
 Anthranilic acid.  
 Anthranilic-acetonitrilic acid.  
 Anthraquinonedisulphonic acid.  
 Anthraquinonesulphonic acids.  
 Apionic acid.  
 Apophyllenic acid.  
*d*-Arabonic acid.  
 Aromadendric acid.  
 Artemic acid.  
 Asparagine.  
 Benzaldehydphenylhydrazone-*p*-sulphonic acid.  
 Benzenepentacarboxylic acid.  
 Benzenesulphinic acid.  
 Benzenesulphonic acid.  
 Benzenethiosulphonic acids.  
 Benzenoid aminosulphonic acids.  
 Benzhydroxamic acid.  
 Benzydimedimalonic acid.  
 Benzilic acid.  
 Benzoic acid.  
 Benzoic-acetic acid.

**Acids.** See:—

Benzoic-toluic acids.  
 Benzosulphurylphenylglycinecarboxylic acid.  
 Benzoylacetacetic acid.  
 Benzoylacetacetic acid.  
 Benzoylaminohectic acids.  
 Benzoylglucylaminoacetic acid.  
 Benzoylglucylglycylaminoacetic acid.  
 Benzoylglucylglycylglycylaminoacetic acid.  
 Benzoyldimethylmalonic acid.  
*N*-Benzoylindoxyllic acid.  
 Benzoyl-*p*-nitrobenzoylacetacetic acid.  
 $\beta$ -Benzoylpicolinic acid.  
 Benzoyltartaric acid.  
 Benzoyl*dithiocarbamic* acid.  
 $\beta$ -Benzylaminocrotonic acid.  
 Benzylaniline-*p*-sulphonic acid.  
 Benzylbromomalonic acid.  
 Benzylcarboxyaconitic acid.  
 $\beta$ -Benzyl-*o*-hydrazinobenzoic acid.  
 Benzylidenacetophenone-acetoacetic acid.  
 $\alpha$ -Benzylideneglutaconic acid.  
 Benzylidene-*o*-hydrazinobenzoic acid.  
 $\alpha$ -Benzylidenelævulic acid.  
 Benzylidenemalic acid.  
 Benzylidenemalonic acid.  
 Benzylmethylacetacetic acid.  
 Benzylphthalamic acid.  
 Berberidic acid.  
 Berberonic acid.  
 Bisdinaphthaxanthylsulphonic acid.  
 Bismuthigallic acid.  
 Bismuthogallic acid.  
 Borneolglycuronic acid.  
 Brazilic acid.  
 Brazilinic acid.  
 Butanedicarboxylic acids.  
 Butanepentacarboxylic acid.  
 Butanetetracarboxylic acids.  
 Butanetricarboxylic acids.  
 $\alpha$ -*iso* Butyl- $\beta$ -*iso*amylacetacetic acid.  
 Butylenehexacarboxylic acid.  
 Butylene-tri- and -penta-carboxylic acids.  
 Butylenetetracarboxylic acids.  
 $\alpha$ -*iso* Butyl- $\beta$ -*iso*propylbutyric acid.  
 $\alpha$ -*iso* Butyl- $\beta$ -*iso*propyl- $\gamma$ -hydroxybutyric acid.  
*iso* Butylpyruvic acid.  
 Butyric acids.  
 Butyrylacetacetic acid.  
 Butyrylbutyric acid.  
 Butyrylpyruvic acid.  
 Cacodylic acid.  
 Caffetannic acid.  
 Calameonic acid.  
 Camphenolglycuronic acid.  
 Campholenic acids.  
*i*- $\alpha$ -Campholytic acid.



**Acids.** See :—

Camphonic acid.  
 Camphononic acid.  
 $\beta$ -Camphoramidic acid.  
 $\beta$ -Camphoranic acid.  
 Camphorenic acid.  
 Camphoric acid.  
 Camphoronic acid.  
*iso*Camphoronic acid.  
 Camphorsulphonic acid.  
 Carbaminoglycylglycine.  
 Carbethoxyphenylglycinecarboxylic acid.  
 Carbonyldiglycylglycine.  
 Carbonyldihydroxydinaphthylamine-disulphonic acids.  
 Carbonyldiphenylglycine.  
 $\alpha$ -Carboxyanilino- $\alpha$ -phenylacetic acid.  
 Carboxydimethoxybenzoylformic acid.  
 Carboxydimethoxybenzylformic acid.  
 2-Carboxy-5:6-dimethoxyphenoxy-acetic acid.  
 Carboxyglutaric acid.  
 2-Carboxy-5-methoxyphenoxyacetic acid.  
 Carboxymethoxyphenoxyacetic acid.  
 3-Carboxy-2-methylfurfuran-4-acetic acid.  
 Carboxyphenylarsenic acids.  
 Carboxytolylarsenic acids.  
 Carvomentholacetic acid.  
 Caseonic acid.  
 Chondroitinsulphuric acid.  
 Chromicyanic acid.  
 Chromone-2-carboxylic acid.  
 Chrysodiphenic acid.  
 Chrysophanic acid.  
 Cinchomerone-3-amic acid.  
 Cinchomeronic acid.  
 Cinchomerylglycine.  
 Cinchotinesulphonic acid.  
 Cinnamenylacrylic acid.  
 Cinnamic acids.  
 Cinnamoylaminoacetic acid.  
 Cinnamylidenemalonic acid.  
 Citralideneacetic acid.  
 Citralideneacetoacetic acids.  
 Citrarialic acid.  
 Citric acid.  
 Cobalticyanic acid.  
 Cobaltioxalic acid.  
 Coccic acid.  
 Cochenillic acid.  
 Corydalinesulphonic acid.  
 Corydic acid.  
 Corydalic acid.  
 Cotarnic acid.  
 Coumarilic acid.  
 $\beta$ -Cresotic acid.  
 Crotonic acid.  
 $\psi$ - and  $p$ -Cumylarsenic acids.  
 Cyanic acid.

**Acids.** See :—

Cyanuric acid.  
*iso*Cyanuric acid.  
 Decenoic acid.  
 Decoic acids.  
 Dehydrocamphoric acid.  
 Dehydromucic acid.  
 Desmotroposantonous acid.  
 Desyleinnamic acid.  
 Desyleneacetic acids.  
 Desylenemalonic acid.  
 Dhurrinic acid.  
 $\gamma\gamma$ -Diacetylbutyric acid.  
 $\beta\beta$ -Diacetyl- $\alpha$ -methylpropionic acid.  
 Diacetylorthonitric acid.  
 Dianilinomalonic acid.  
 2:6-Dianilinopyridine-4-carboxylic acid.  
 Di- $\alpha$ -anisylidihydrazonecyanooacetic acid.  
 Di- $\alpha$ -anisylidihydrazoneomalonic acid.  
 Dibenzoylmesitylenic acids.  
 Dibenzoyltartaric acid.  
 Dibenzoyltrimesic acid.  
 Dibenzoylavitic acids.  
 Dibenzylideneacetone-acetoacetic acid.  
 Dibenzylidenekævulic acid.  
 Dicarboxyaconitic acid.  
 Dicarboxyglutaconic acid.  
 Dicarboxyglutaric acid.  
 Dicarboxyphenylarsenic acid.  
 3:5-Dicarboxypyrrole-2:4-diacetic acid.  
 Diethylaminoacetic acid.  
 Diethylarsinibenzoic acid.  
 $p$ -Diethylarsinobenzoic acid.  
 $s$ - $\alpha\alpha$ -Diethylglutaric acid.  
 Diethylglycollic acid.  
 Diethyl- $\alpha$ -naphthylamine-5-sulphonic acid.  
 Diethyl- $\alpha$ -toluidine-4-sulphonic acid.  
 Digitic acid.  
 Digitogenic acid.  
 Digitoic acid.  
 Dihydrobrazilic acid.  
 $\alpha$ -Dihydrocampholenic acid.  
 Dihydrocampholytic acids.  
 Dihydrocamphoric acid.  
 Dihydrocarbostyryl-4-acetic acid.  
 Dihydrocornicularic acid.  
 Dihydrofencholenic acid.  
 Dihydrolutidinedicarboxylic acid.  
 Dihydro-2-lutidone-3:5-dicarboxylic acid.  
 $\Delta^{15}$ -Dihydro- $m$ -tolylacetic acid.  
 2:6-Dihydroxycinchomeronic acid.  
 2:2'-Dihydroxydiphenyl-di- and -tetra-sulphonic acids.  
 3:4-Dihydroxyhydratropic acid.  
 1:1'-Dihydroxy-6:6'-ketoethylenedi-naphthylamine-3:3'-disulphonic acid.

**Acids.** See :—

- 4:7-Dihydroxy-6-methoxydihydro-quinaldine-5-carboxylic acid.  
 $\gamma\delta$ -Dihydroxy- $\gamma$ -methyl- $\gamma$ -ethylpyrotartaric acid.  
 2:3-Dihydroxynaphthalene-6:8-disulphonic acid.  
 Di-3- and -*o*-hydroxy-2-phenylquinoxalinesulphonic acid.  
 Dihydroxyisopropylhypophosphorous acid.  
 2:6-Dihydroxypyridine-3:4-di- and -3:4:5-tri-carboxylic acids.  
 1:2-Diketopentamethylene-3:5-dicarboxylic acid.  
 Dimethoxybenzoylpropionic acid.  
 5:7-Dimethoxychromone-2-carboxylic acid.  
 4:6-Dimethoxycoumaric acid.  
 4:6-Dimethoxycoumarilic acid.  
 3:4-Dimethoxyhydratropic acid.  
 Dimethoxymethylenedioxyhydratropic acid.  
 Dimethylacetoacetic acid.  
 Dimethylacrylic acid.  
 $\beta\beta$ -Dimethyladipic acid.  
 Dimethylaminoacetic acid.  
*p*-Dimethylaminobenzylidene-*p*-aminobenzenesulphonic acid.  
 $\gamma$ -Dimethylaminobutyric acid.  
 Dimethylaminophenylarsenic acid.  
 $\beta$ -Dimethylaminopropionic acid.  
 Dimethylaniline-6-carboxylic acid.  
 Dimethylaniline-6-sulphonic acid.  
 Dimethyl*d*ibromoethylacetic acid.  
 $\alpha\alpha$ -Dimethylbutane- $\alpha\beta\delta$ -tricarboxylic acid.  
 $\beta\gamma$ -Dimethyl- $\alpha$ -isobutylvaleric acid.  
 $\beta\gamma$ -Dimethylbutyrolactoneacetic acid.  
 $\beta\gamma$ -Dimethylcrotonolactoneacetic acid.  
 3:5-Dimethyl- $\Delta^{1:5}$ -dihydrophenylacetic acid.  
 2:4-Dimethylfurfuran-3-carboxylic acid.  
 $\alpha\alpha$ -Dimethylglutaconic acid.  
 Dimethylglutaric acids.  
 1:3-Dimethyl-5-cyclohexanecarboxylic acid.  
 1:1'-Dimethylcyclohexanemalonic acid.  
 3:5-Dimethylcyclohexane-3-ol-1-one-4:6-dicarboxylic acid.  
 Dimethylhomophthalcarboxylic acid.  
 Dimethylmalonic acid.  
 Dimethyl- $\alpha$ -naphthylaminesulphonic acids.  
 2:6-Dimethylnicotinic acid.  
 Dimethylloxazolepropionic acids.  
 Dimethylphloroglucinolcarboxylic acid.  
 Dimethylphthalide-acetic, -bromotetronic and -tetronic acids.

**Acids.** See :—

- $\alpha\beta$ -Dimethylpropanetricarboxylic acid.  
 2:4-Dimethylpyridine-3:5-di- and -3:5:6-tri-carboxylic acids.  
 Dimethylpyronedicarboxylic acid.  
 4:6-Dimethyl-1:2-pyrone-5-carboxylic acid.  
 Dimethylpyruvic acid.  
 $\gamma\epsilon$ -Dimethylsorbic acid.  
 Dimethylsuccinic acid.  
 Dimethyltricarballic acids.  
 Dimethyltrimethylenedicarboxylic acid.  
 Dimethylvinylacetic acid.  
 Dimethylviolic acid.  
 1:4-Dioxyopyrinedicarboxylic acid.  
 Dioxysylvic acid.  
 Dioxytariric acid.  
 Diphenylacetic acid.  
 $\gamma\delta$ -Diphenylallylacetic acid.  
 Diphenyldihydrazonocyanoacetic acid.  
 Diphenyldihydrazonemalonic acid.  
 $\beta\beta$ -Diphenyl- $\alpha\alpha$ -dimethylpropionic acid.  
 Diphenyl-4:4'-disulphonic acid.  
 Diphenyleneketonecarboxylic acid.  
 Diphenylenequinoxalinesulphonic acid.  
 Diphenylglycollic acid.  
 Diphenylmethane-3:3'-dicarboxylic acid.  
 Diphenylmethylpyrrolecarboxylic acids.  
 $\gamma\delta$ -Diphenyl- $\gamma$ -pentenoic acid.  
 1:4-Diphenylpyrrolidone-mono- and -5:5-di-carboxylic acids.  
 Diphenyltetramethylenebisbromomethyleneacetic acid.  
 Diphenyltetramethylenebismethylene-malonic acid.  
 Diphenyltetrenecarboxylic acid.  
 Diphenyltetrenedicarboxylic acid.  
 Diphenylthiocyanoacetic acid.  
 $\alpha\delta$ -Diphenylvaleric acid.  
 Dipropionylorthonitric acid.  
 $\alpha\gamma$ -Diisopropyltricarballic acids.  
 Dipyrrolylsuccinic acids.  
 Disulphobenzoic acid.  
 Di-*o*-tolylidihydrazonocyanoacetic acid.  
 Di-*o*-tolylidihydrazonemalonic acid.  
 Diurethanepyruvic acid.  
*d*-Erythronic acid.  
 Ethanedicarboxylic acid.  
 Ethanetetracarboxylic acid.  
 Ethoxyanilinophosphoric acid.  
 4-Ethoxy-4-isobutylquinolnitrolic acid.  
 Ethoxydeoxybenzoincarboxylic acids.  
 4-(or 5)-Ethoxydibenzyl-2-carboxylic acid.  
 4-Ethoxy-2:6-dimethylnicotinic acid.

**Acids.** See :—

δ-Ethoxy-β-hexanone-ε-carboxyl-  
 amide-γ-carboxylic acid.  
 3-Ethoxyphenanthrene-10-carboxylic  
 acid.  
*p*-Ethoxyphenylacetic acid.  
 α-*p*-Ethoxyphenyl-*o*-amino- and -*o*-  
 nitro-cinnamic acids.  
*p*-Ethoxyphenylsuccinamic acid.  
 β-Ethoxyphthalylacetic acid.  
 4-(or 5)-Ethoxystilbene-2-carboxylic  
 acid.  
*p*-Ethoxysuccinamic acid.  
 Ethoxysulphinic acid.  
 Ethoxy-*p*-toluidinophosphoric acid.  
 Ethylbutyrylacetic acid.  
 Ethylcarboxyaconitic acid.  
 Ethylenebis-1-tetrahydroisoquinoline-  
 1-acetic acid.  
 Ethylenedicarboxylic acid.  
 Ethylhexoylacetic acid.  
 Ethylideneacetoacetic acid.  
 Ethylidenebisacetoacetic acid.  
 α-Ethylidenediglutacetic acid.  
 α-Ethylideneglutaric acid.  
 γ-Ethylidenelactic acid.  
 Ethylmalonic acid.  
 3-Ethylpyridine-4-carboxylic acid.  
 1-Ethyltetrahydroquinolinecarboxylic  
 acid.  
 Eudesmic acid.  
 Euxanthic acid.  
 Ferribenzoylacetic acid.  
 Ferricyanic acid.  
 Ferrioxalic acid.  
 Ferrisalicilic acid.  
 Ferrocyanic acid.  
 Filixic acid.  
 Flavaspidic acids.  
 Fluorenicarboxylic acid.  
 Fluorene-oxalic acid.  
 Fluorenone-5-carboxylic acid.  
 Formic acid.  
 Formylphenylacetic acid.  
 Fumaric acid.  
 Furfurandicarboxylic acid.  
 Furfuransulphonic acid.  
 Furfurylcarbamie acid.  
 β-Furfurylglutaric acid.  
 Galactonic acid.  
 Gallic acid.  
 Gitonic acid.  
 Glomellic acid.  
 Glucophosphoric acid.  
 Glutaconic acid.  
 Glutamic acid.  
 Glutaric acids.  
 Glycero-arsenic acid.  
 Glycerophosphorous acid.  
 Glycine.  
 Glycoeyamine.  
 Glycollic acid.

**Acids.** See :—

Glycuronic acid.  
 Glycylglycine.  
 Glycylglycinecarboxylic acid.  
 Glycylglycyl-leucinecarboxylic acid.  
 Glyoxylic acid.  
 Guaiacoloxyfumaric acid.  
 Guaiacolsulphonic acid.  
 Hæmatoxylinic acid.  
 Hemotricarboxylic acids.  
 Hemipinic acids.  
*cyclo*Heptanecarboxylic acid.  
 Heptanedicarboxylic acid.  
*cyclo*Heptane-1-olacetic acid.  
 Heptane-αγγεη-hexacarboxylic acid.  
 Heptenoic acid.  
 Heptoic acid.  
 Hexahydrobenzoic acid.  
 Hexahydrotidinedicarboxylic acid.  
 Hexahydro-*o*-toluic acid.  
*cyclo*Hexanecarboxylic acid.  
 Hexanedicarboxylic acids.  
 Hexanetricarboxylic acid.  
 Hexenoic acid.  
 Hexoic acids.  
 Hexoylacetic acid.  
 Hexoylacetacetic acid.  
*sec*-Hexylacetacetic acid.  
*cyclo*Hexylbenzenesulphonic acid.  
 Hexylbutyrlactic acid.  
 Hippuric acid.  
 Homo-allantoic acid.  
 Homonicotinic acid.  
 Homoparacopaivic acid.  
 Homopilomalic acid.  
*iso*Hydrochelidonic acid.  
 Hydrocinnamic acid.  
 Hydroxamic acids.  
 Hydroxamino-oximinomalonic acid.  
*m*-Hydroxy-*o*-isoamylbenzoic acid.  
 5-Hydroxy-2-anilidonaphthalene-7-  
 sulphonic acid.  
 Hydroxyanthraquinonesulphonic  
 acids.  
 Hydroxybenzoic acids.  
*o*-Hydroxybenzylideneacetoacetic acid.  
 Hydroxybutyric acids.  
 β-Hydroxycamphoronic acid.  
 4-Hydroxyisocarbostyrylphthaloylic  
 acid.  
*p*-Hydroxycinnamic acid.  
 Hydroxycoumaric acid.  
*p*-Hydroxycumylacetic acid.  
 Hydroxydehydroisophotosantoniac acid.  
 β-Hydroxy-αα-diethylglutaric acid.  
 4-Hydroxydihydrofencholenic acid.  
 β-Hydroxy-αα-dimethylglutaric acid.  
 6-Hydroxy-2:5-dimethylpyridine-3-  
 carboxylic acid.  
 Hydroxydiphenylacetic acid.  
 Hydroxydiphenylaminesulphonic  
 acids.

**Acids.** See :—

- 2-Hydroxy-5-ethoxybenzoylpyruvic acid.
- $\alpha$ -Hydroxy-4-(or 5)-ethoxydibenzyl-2-carboxylic acid.
- m*-Hydroxy-*o*-ethylbenzoic acid.
- Hydroxyglutaric acids.
- m*-Hydroxyhexahydrobenzoic acid.
- p*-Hydroxyhexahydrotolnic acid.
- 6-Hydroxy-2-keto- $\Delta^{3,5}$ -dihydropyridinetricarboxylic acid.
- 1-Hydroxylaminoanthraquinone-2-sulphonic acid.
- 2-Hydroxy-4:6-lutidine-3-carboxylic acid.
- o*-Hydroxymandelic acid.
- o*-Hydroxymercurisalicic acid.
- 6-Hydroxy-4-methoxybenzoylpropionic acid.
- 2-Hydroxy-4-mono- and -4:6-dimethoxybenzoylpyruvic acids.
- p*-Hydroxy-*m*-methoxyphenylmethanebis-2:5-dimethylpyrrole-3-carboxylic acid.
- $\beta$ -Hydroxy- $\beta$ -methyl- $\alpha$ -ethylbutyric acid.
- 2-Hydroxy-4-methylquinoline-3-carboxylic acid.
- Hydroxymethylsalicylic acid.
- 6-Hydroxymethyl-2:3:4-trimethylquinolinic acid.
- o*-Hydroxynaphthoic acids.
- 2-Hydroxy-3-naphthoic acid.
- 1-Hydroxy-2-naphthoylpyruvic acid.
- 4-Hydroxynicotinic acid.
- o*-Hydroxyphenylmethanebis-2:5-dimethylpyrrole-3-carboxylic acid.
- $\beta$ -4-Hydroxyphenyl- $\beta$ -methoxypropionic acid.
- $\beta$ -4-Hydroxyphenylpropionic acid.
- m*-Hydroxyphenyl-*p*-tolylaminesulphonic acids.
- m*-Hydroxyphenyl-*p*-tolylnitrosaminesulphonic acid.
- 4-Hydroxyphthalic acid.
- $\beta$ -Hydroxy- $\beta$ -piperonyl- $\alpha$ -dimethylpropionic acid.
- Hydroxypivalic acid.
- $\alpha$ -Hydroxypropionic acid.
- $\epsilon$ -Hydroxy- $\beta$ -isopropylheptoic acid.
- Hydroxyisopropylhypophosphorous acid.
- Hydroxyisopropylphosphinic acid.
- Hydroxypyrrolidine-2-carboxylic acid.
- Hydroxyterephthalic acid.
- 2-Hydroxy-*m*-toluic acid.
- 8-Hydroxy-2-*o*-tolylaminonaphthalene-6-sulphonic acid.
- $\beta$ -Hydroxy- $\beta$ -*p*-tolyl- $\alpha\alpha$ -dimethylpropionic acid.
- $\beta$ -Hydroxy- $\beta$ - $\gamma\gamma$ -trimethylpentanedioic acid.

**Acids.** See :—

- $\gamma$ -Hydroxyundecioic acid.
- Hydroxyvaleric acids.
- p*-Hydroxy-*p*-xylylacetic acid.
- 5-Hydroxy-2-*o*-xylylaminonaphthalene-7-sulphonic acid.
- Illuric acid.
- Indigotinsulphonic acid.
- Indole-2-carboxylic acid.
- Indoneacetic acids.
- Indophenazinecarboxylic acid.
- Iononecarboxylic acids.
- Isatoic acid.
- Isoprenic acid.
- Kairolinocarboxylic acids.
- Ketocampholenic acid.
- Ketodihydrocampholenic acid.
- $\gamma$ -Keto- $\alpha\delta$ -diphenyliminopentane- $\alpha$ -carboxylic acid.
- Keto-3:5-diphenyl- $\Delta^2$ -tetrahydrobenzene-6-carboxylic acid.
- Ketohexyltetronic acid.
- 2-Ketomethylhexamethylenecarboxylic acid.
- $\alpha$ -Keto- $\beta$ -methylhexolactone- $\gamma$ -carboxylic acid.
- 2-Ketomethylisopropylhexamethylene carboxylic acid.
- 1-Keto-5-phenyl-3-cinnamenyl- $\Delta^2$ -tetrahydrobenzene-6-carboxylic acid.
- $\epsilon$ -Keto- $\beta$ -isopropylheptoic acid.
- $\delta$ -Keto- $\beta$ -isopropylhexoic acid.
- Ketotariric acid.
- Lactic acids.
- Lauric acid.
- Lauronic acid.
- o*-Leucauraminobenzoic acid.
- Leucine.
- Leucylleucine.
- Lupinic acid.
- Lutidinedicarboxylic acid.
- $\psi$ -Lutidostyryl-5-carboxylic acid.
- Lysalbic acid.
- Malamic acid.
- Malic acid.
- $\beta$ -isoMalic acid.
- Malondihydroxamic acid.
- Malonic acid.
- Malontetranilic acid.
- Mancopalenic acid.
- Mancopalic acid.
- Mancopalolic acid.
- Manelemic acids.
- Mellic acid.
- Mentholacetic acid.
- Mentholglycuronic acid.
- Mercaptothionic acid.
- Mercuribenzoic acid.
- $\beta$ -Metacopaivic acid.
- Metanilic acid.
- Methanedisulphonic acid.
- Methenyldianthranilacetic acid



**Acids. See:—**

Methoxyanilinophosphoric acid.  
 7-Methoxychromone-2-carboxylic acid.  
 4-Methoxy-4-ethoxyquinol-1-nitrolic acid.  
*p*-Methoxyhydratropic acid.  
 2-Methoxyphenanthrene-9-carboxylic acid.  
 $\alpha$ -Methoxyphthalic acid.  
*p*-Methoxysalicylic acid.  
 Methoxysulphinic acid.  
 Methoxy-*p*-toluidinophosphoric acid.  
 Methylantranilic acid.  
 Methylarsenic acid.  
 $\delta$ -Methyl- $\alpha$ -isobutylhexoic acid.  
 Methylcamphocarboxylic acid.  
 Methylcarboxyaconitic acid.  
 Methylene- $\alpha$ -alanine.  
 Methylenebisanthranilic acid.  
 Methyleneecitric acid.  
 Methylenedi-2-hydroxy-3-naphthoic acid.  
 Methylenedimethylsuccinic acid.  
 Methylenedioxyphenylmethanebis-2:5-dimethylpyrrole-3-carboxylic acid.  
 Methylenedisuccinic acid.  
 $\gamma$ -Methyl- $\gamma$ -ethylaconic acid.  
 Methyleneethylaminoacetic acid.  
 5-Methyl-3-ethyl- $\Delta^{3:5}$ -dihydrophenylacetic acid.  
 $\gamma$ -Methyl- $\gamma$ -ethylidenepyrotartaric acid.  
 $\gamma$ -Methyl- $\gamma$ -ethylparaconic acid.  
 Methylfluorenoxalic acid.  
 Methylhexahydrocinchonimeronic acid.  
 1-Methylcyclohexane-3-acetic and -3-malonic acids.  
 Methylcyclohexanecarboxylic acids.  
 1-Methylcyclohexane-3-ol-3-acetic acid.  
 1-Methylcyclohexane-3-ol-3-butyric acid.  
 1-Methylcyclohexane-3-ol-3-propionic acid.  
 1-Methylcyclo- $\Delta^3$ -hexene-3-acetic acid.  
 Methylhexenoic acids.  
 $\delta$ -Methylhexoic acid.  
 Methylhexylpyruvic acid.  
*N*-Methylindoxyllic acid.  
 Methylmalonamic acid.  
 Methylnaphthylaminesulphonic acids.  
 Methylparaconic acid.  
 1-Methylcyclopentane-3-carboxylic acid.  
 $\beta$ -Methylcyclopentanemethylidenecarboxylic acid.  
 $\beta$ -Methylcyclopentanolacetic acid.  
 $\beta$ -Methyl- $\delta$ -pentanone- $\alpha\alpha$ -dicarboxylic acid.  
 Methylphloroglucinolcarboxylic acid.  
 $\beta$ -Methylpimelic acid.

**Acids. See:—**

1-Methylpiperidine-2:6-dicarboxylic acid.  
 $\alpha$ -Methyl- $\delta$ -isopropyladipic acid.  
 $\delta$ -Methyl- $\alpha$ -isopropylhexoic acid.  
 4-Methylpyrazoledicarboxylic acid.  
 Methylpyridinecarboxylic acids.  
 Methylpyridinetricarboxylic acid.  
 2-Methyl-6-pyridylacetic acid.  
 4-Methylpyrimidine-6-carboxylic acid.  
 2-Methylpyrrole-3:4:5-tricarboxylic acid.  
 1-Methylpyrrolidine-2-mono- and -2:5-di-carboxylic acids.  
 Methylrubazonic acid.  
 5-Methylsalicylic acid.  
 $\gamma$ -Methylsorbic acid.  
 1-Methyltetrahydroquinolinecarboxylic acids.  
 Methyltetramethylenedicarboxylic acid.  
 Methyltetronic acid.  
 Methyl*dl*thiocarbamic acid.  
 Methylthiocyanomalonic acid.  
 $\alpha$ -Methyltricarballic acids.  
 $\beta$ -Methyluracil-4-carboxylic acid.  
 $\delta$ -Methyluric acid.  
 Montanic acid.  
 Mucobromic acid.  
 Mucochloric acid.  
 Muconic acid.  
 $\alpha$ -Naphthachromonecarboxylic acid.  
 Naphthalaldehydic acid.  
 Naphthalene-1:2-dicarboxylic acid.  
 Naphthalenedisulphonic acid.  
 Naphthalenoidaminosulphonic acids.  
 Naphthalene-8-sulphonic acid.  
 Naphtharonylacetic acid.  
 Naphthenecarboxylic acids.  
 Naphthoic acids.  
 Naphtholsulphonic acids.  
 Naphthoxyfumaric acids.  
 $\beta$ -Naphthylamine-8-sulphonic acid.  
 $\beta$ -Naphthylamino-3-naphthoic acid.  
 Nicotinic acid.  
*iso*Nicotinic acid.  
 Niobioxalic acid.  
 Nonanedicarboxylic acid.  
 Nonanetricarboxylic acids.  
 Nonoic acid.  
 Norbraziliinic acid.  
 Norisosaeharic acid.  
 Oehrolechiasic acid.  
 Octanedicarboxylic acid.  
 Opianic acid.  
 Ornithine.  
 Orthoformic acid.  
 Osmyloxalic acid.  
 Oxalacetic acid.  
 Oxalic acid.  
 Oxalodihydroxamic acid.  
 Oxaluric acids.

**Acids.** See :—

Oximinocynoacetic acid.  
 Oximinomalonic acid.  
 Oximinomalon-*o*-tolylamic acid.  
 Oximino-oxalic acid.  
 $\alpha$ -Oximinovaleic acid.  
*p*-Oxydiethylarsinibenzoic acid.  
 Oxyfulminic acid.  
 Oxymethylpyridonecarboxylic acid.  
*allo*Oxyproteic acid.  
 Palmitic acid.  
 Papaveric acid.  
 Paracopaivic acid.  
 Pentanedicarboxylic acids.  
 Pentanehexacarboxylic acid.  
*cyclo*Pentanemethylidenecarboxylic acid.  
 Pentanetetracarboxylic acids.  
 Pentanetricarboxylic acids.  
*cyclo*Pentanolacetic acid.  
 Pentenedicarboxylic acids.  
 Pentenetetracarboxylic acid.  
 Pentenoic acids.  
 Pepsinic acid.  
*iso*Persulphocyanic acid.  
 Phellandrenolglycuronic acid.  
 Phenanthraquinonecarboxylic acids.  
 Phenanthraquinonesulphonic acid.  
 Phenanthrene-9-carboxylic acid.  
 Phenanthrenesulphonic acids.  
 Phenanthroic acids.  
 Phenanthroxyacetic acids.  
*p*-Phenethylthiohydantoic acid.  
 Phenolglycuronic acid.  
 Phenol-6-sulphonic acid.  
 Phenolsulphuric acid.  
 Phenylacetic acid.  
 Phenylacetic-benzoic acid.  
 Phenylalanine.  
 Phenylallophanic acid.  
 Phenylarsenic acid.  
 Phenylarsenious acid.  
 $\gamma$ -Phenyl- $\alpha$ -benzoylacetacetic acid.  
 Phenylbromomalonic acid.  
 Phenylcarboxyaconitic acid.  
 Phenyl- $\alpha$ -chloroacetic acid.  
 Phenylcinnamic acid.  
 4-Phenyldihydro-2-picolone-5-carboxylic acid.  
 1-Phenyl-3:5-dimethylpyrazole-4-acetic acid.  
 Phenyl dimethylpyrazolepropionic acids.  
 1-Phenyl-2:5-dimethylpyrrole-3-carboxylic acid.  
*m*-Phenylenediamine-5-carboxylic acid.  
 Phenylethylenedianthranilic acid.  
 $\beta$ -Phenylethylcarbamic acid.  
 $\gamma$ -Phenyl- $\gamma$ -ethylidenepyrotartaric acid.  
 $\gamma$ -Phenyl- $\gamma$ -ethylitaconic acids.

**Acids.** See :—

Phenylethyl*d*ithiocarbamic acid.  
 $\beta$ -Phenylglutaranilic acid.  
 Phenylglutaric acids.  
 Phenylglycine.  
 Phenylglycine-*o*-carboxylic acid.  
 Phenylglycine-*o*-dicarboxylic acid.  
 Phenylglycinehydroxamic acid.  
 Phenylglycollic acid.  
 Phenylmethanebis-2:4- and -2:5-dimethylpyrrole-3-carboxylic acids.  
 $\alpha$ -Phenyl- $\beta$ -3-methoxy-6-amino- and -6-nitro-cinnamic acids.  
 3-Phenyl-5-methylfurfuran-2:4-dicarboxylic acid.  
 Phenylmethylglycine.  
 5-Phenyl-3-methyl*cyclo*hexan-3-ol-1-one-4:6-dicarboxylic acid.  
 4-Phenyl-6-methyl-1:2-pyrone-5-carboxylic acid.  
 3-Phenyl-5-methylpyrrole-4-carboxylic acid.  
 8-Phenylmethylsuccinic acid.  
 Phenylmethyl*d*ithiocarbamic acid.  
 1-Phenyl-5-methyl-1:2:3-triazole-4-carboxylic acid.  
 2-Phenylnaphthalene-1:7-dicarboxylic acid.  
 Phenyl- $\beta$ -naphthylamine-6-sulphonic acid.  
 Phenylnitrocinnamic acids.  
 Phenylisonitrosoglycine.  
 Phenylloxamic acid.  
 Phenyl oxyarsinodiarylcarboxylic acids.  
 Phenylparaconic acid.  
 Phenylphthalamic acid.  
 $\alpha$ -Phenylpropane- $\alpha\alpha\gamma$ -tricarboxylic acid.  
 Phenylpropionic acid.  
 Phenylpropionic acid.  
 Phenylpyrazolecarboxylic acid.  
 4-Phenylpyrazole-3:5-dicarboxylic acid.  
 3-Phenylpyridine-2:6-dicarboxylic acid.  
 6-Phenyl-2-pyridylacrylic acid.  
 2-Phenylpyrimidine-6-carboxylic acid.  
 Phenylpyrrole-2-mono- and -2:5-dicarboxylic acids.  
 3-Phenylpyrrole-4-carboxylo-5-acetic acid.  
 Phenylsemicarbazidedicarboxylic acid.  
 Phenyl*d*ithiocarbazinic acid.  
 Phenylthiocynoacetic acid.  
 Phenylthiocyanomalonic acid.  
 Phenyltolylethersulphonic acids.  
 1-Phenyl-1:2:3-triazolecarboxylic acids.

**Acids.** See :—

Phenyltrimethylenedicarboxylic acid.  
 Phloroglucinolcarboxylic acid.  
 Phosphomannitic acid.  
 Photosantonin acids.  
 Phthalamic acid.  
 Phthalhydroxylamic acid.  
 Phthalic acids.  
 Phthaliminocamylmalonic acid.  
 Piccapimarinic acid.  
 Picipimaric acid.  
 Picipimarolic acids.  
 $\gamma$ -Picolone-3:5-di- and -tetra-carboxylic acids.  
 Picolinic acid.  
 Picric acid.  
 Picrolichenic acid.  
 Pilocarpic acid.  
*iso*Pilocarpic acid.  
 Pilocarpoic acid.  
 Pilomalic acid.  
 Piluvic acid.  
 Pimelic acid.  
 Pinenolglycuronic acid.  
 Piperidine-1-acetic acid.  
 Piperidinecarbamie acid.  
 Pivalic acid.  
 Propaldehyde- $\beta\beta$ -disulphonic acid.  
 Propanedicarboxylic acid.  
 Propanetetra-carboxylic acid.  
 Propanetricarboxylic acids.  
*iso*Propenyltrimethylenedicarboxylic acid.  
 Propionic acid.  
 Propionylacetoacetic acid.  
*iso*Propyl*iso*amylacetic acid.  
*iso*Propyl*iso*butylsuccinic acid.  
 4-*iso*Propyldihydroresorcylic acid.  
 Propylenedicarboxylic acid.  
 Propylenepentacarboxylic acid.  
 Propylenetetra-carboxylic acid.  
 Propylenetricarboxylic acids.  
 $\beta$ -*iso*Propylglutaric acid.  
 $\beta$ -*iso*Propylheptic acid.  
 Propylidenebisacetoacetic acid.  
*iso*Propylisovaleric acid.  
 Propylmalonamic acid.  
 4-*iso*Propylphenyldihydro-2-picolone-5-carboxylic acid.  
*iso*Propylsuccinanilic acid.  
*iso*Propylsuccinic acid.  
*iso*Propyltrimethylenedicarboxylic acid.  
 Protalbic acid.  
 Protelemic acid.  
 Protocatechuic acids.  
 Protolichestic acid.  
 Pulegenic acid.  
 Pulegolacetic acid.  
 Purpurogallinearboxylic acid.  
 Pyrazolecarboxylic acids.  
 Pyrazolone-3-acetic acid.

**Acids.** See :—

Pyridazyl-3-*p*-benzoic acid.  
 Pyridinecarboxylic acids.  
 Pyridine-2:3-dicarboxylic acid.  
 Pyridine-3:4:5-tri- and -penta-carboxylic acids.  
 Pyridoylacetic acid.  
 2-Pyridoylaminoacetic acid.  
 2-Pyridylethylacetic acid.  
 $\beta$ -2-Pyridoylpropionic acid.  
 Pyridylacrylic acid.  
 2-Pyridylbromopropionic acids.  
 Pyridylchlorohydroxyquinolsulphonic acid.  
 3-Pyridylglycine-4-carboxylic acid.  
 2-Pyridyl- $\beta$ -propionic acid.  
 Pyridyltruxillic acid.  
 Pyrimidine-4:6-dicarboxylic acid.  
 Pyridanedionecarboxylic acid.  
 Pyrogallolsulphonic acid, triethylether.  
 Pyromeconic acid.  
 Pyromucic acid.  
*iso*Pyromucic acid.  
 Pyroracenic acid.  
*n*-Pyrotartaric acid.  
 Pyrrolecarboxylic acids.  
 2-Pyrrolidinecarboxylic acid.  
 Pyruvic acid.  
 Pyruvylphenylhydrazonchydroxamic acid.  
 Pyruvylpyruvic acid.  
 Quinolinic acid.  
 Rhammonic acid.  
 Rufigallic acid.  
 Sabinenolglycuronic acid.  
 Sabinolglycuronic acid.  
*iso*Saccharic acid.  
 Salicylglycollic acid.  
 Salicylhydroxamic acid.  
 Salicylic acid.  
*iso*Salicylic acid.  
 Sorbic acid.  
 Styrylmethanebis-2:5-dimethylpyrrole-3-carboxylic acid.  
 Succinic acid.  
 Sulphanilic acid.  
 Sulphoacetic acid.  
*m*-Sulphobenzoic acid.  
 Sulphocampholenecarboxylic acid.  
 Sulphohydroxamic acids.  
 Sulphosalicylic acid.  
 Sylvic acid.  
 Tanacetonedicarboxylic acid.  
 Tartric acid.  
 Tartaric acid.  
 Terephthalic acid.  
 Terpenylic acid.  
 Tetrahydroquinolinecarboxylic acids.  
 Tetrahydroxyhexoic acid.  
 Tetrahydroxysylvic acid.  
 Tetrahydroxyvaleric acid.  
 Tetramethyldiaminoacetic acid.

**Acids.** See:—

Tetramethyldiaminodiphenylmethyl-  
dithiocarbamic acid.  
Tetramethyldiaminomaleonic acid.  
Tetraoxysilvic acid.  
Tetronic acid.  
diThiocarbamic acid.  
Thiocyanic acid.  
 $\alpha$ -Thiophenecarboxylic acid.  
Thujamenthoketonic acid.  
Thujonehydraglycuronic acid.  
*o*-Toluenesulphinic acid.  
Toluene-*p*-sulphonic acid.  
Toluic acids.  
*o*-Toluidinoacrylic acid.  
Toluidinomethylenemalonie acids.  
*p*-Toluidinophosphamic acid.  
*p*-Toluoyletartaric acid.  
*o*-Tolylallophanic acid.  
Tolyl-2:5-dimethylpyrrole-3:4-dicarboxylic acids.  
Tolylenebis-2:5-dimethylpyrrole-3:4-dicarboxylic acids.  
 $\beta$ -*p*-Tolylglutaranilic acid.  
 $\beta$ -*p*-Tolylglutaric acid.  
*p*-Tolyl-*m*-hydroxyphenazinesulphonic acid.  
*p*-Tolyl- $\alpha$ -naphthylaminesulphonic acid.  
*o*-Tolylloxamic acid.  
Tolylloxaminosulphonic acids.  
*o*-Tolylphthalamic acid.  
Tolylthioglycollic acids.  
Tolylthiohydantoic acids.  
Triacetylglactonic acid.  
Tribenzylamine-*m*-tricarboxylic acid.  
Tricarballic acid.  
Triethylbenzenesulphonic acids.  
Trihydroxybutyric acid.  
 $\alpha\beta\gamma$ -Trihydroxy- $\alpha\delta$ -diphenylvaleric acid.  
2:3:8-Trihydroxynaphthalene-6-sulphonic acid.  
Trimethylenecarboxylic acid.  
Trimethylenetetracarboxylic acid.  
Trimethylenetricarboxylic acid.  
Trimethylitamic acid.  
2:3:4-Trimethylnicotinic acid.  
Trimethylparaconic acid.  
Trimethylpentane- $\beta\epsilon$ -olidoic acids.  
Trimethylpentanoic acid.  
Trimethylquinolinic acid.  
Trimethylsuccinic acid.  
Triphenylmethanesulphonic acid.  
Triconucleic acid.  
Tropic acids.  
 $\alpha$ -Truxillic acid.  
Tyrosine.  
Undecoic acids.  
Urano-malic and -tartaric acids.  
Uric acids.  
Usnaric acid.

**Acids.** See:—

Usnic acids.  
Usnidic acid.  
Valeric acids.  
*iso*Valerylacetic acid.  
*iso*Valerylacetoacetic acid.  
Variolaric acid.  
Veratric acid.  
Vinylacetic acid.  
Vinylacrylic acid.  
Xanthic acid.  
Xanthine-4:5-dicarboxylic acid.  
Xylenedicarboxylic acid.  
*m*-Xylidinomethylenemalonie acid.  
*l*-Xylonic acid.  
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4-Acetylaminophenol.

Acetylcarbinol (*acetol*).

Allyl alcohol.

$\beta$ -Allylbenzene glycol.

Amyl alcohols.

Anthragallol.

Anthranols.

Arabitol.

Aspidinol.

Benzhydrol.

Benzhydryl-5-fluorenel.

1:4-Benzopyranols.

4-Benzoylaminophenol.

Benzoylthymol.

6-Benzoyl-1:2:4-xlenol.

6-Benzoyl-1:4:2-xlenol.

Benzyl alcohol.

Boletol.

Borneols.

Butyl alcohols.

Butylene chlorohydrins.

$\alpha$ -*iso*Butyl- $\beta$ -*isopropyl*trimethylene glycol.

Camphanylcarbinol.

Camphenylcarbinol.

Camphyl glycols.

Catechol.

*iso*Chavibetol.

Chlorohydrins.

Cholesterols.

Chrysanthrol.

Cineol.

Cresols.

$\psi$ -Cumenol.

Decinyl alcohol.

Decyl alcohol.

$\alpha\gamma$ -Decylene glycol.

Dehydrocamphylcarbinol.

Dehydromenthylcarbinol.

Dehydropyrodypnopinacolyl alcohol.

Dibutyl alcohol.

Diethylcarbinol.

Diheptyl alcohol.

Dihydro*isophoryl* glycols.

1:5-Dihydroxyanthranol.

Dihydroxydibenzylmesitylene.

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2:4'-Dihydroxydiphenylmethane.

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2:3-Dihydroxynaphthalene.

Dihydroxynonane.

9:10-Dihydroxyphenanthrene.

Dihydroxy-2-phenyl-1:4-benzopyranols.

Dihydroxy-2-phenyl-4-benzylidene-1:4-benzopyranols.

Dimethoxyanhydroglycogallol.

$\alpha\beta$ -Dimethoxydihydro*isoeugenol*.

2:4-Dimethoxydimethyl-3-methyl- and -5-bromomethyl-1-phenol.

3:5-Dimethoxy-2-methylcarbinol-6-aminophenol.

Dimethoxy-2-phenyl-4-benzylidene-1:4-benzopyranols.

Dimethyl*iso*amylcarbinol.

Dimethylheptenol.

$\beta\epsilon$ -Dimethylhexane- $\beta\epsilon$ -diol.

1:3-Dimethyl*cyclo*hexanol.

Dimethylhydroxyethylamine.

2- $\alpha$ -Dimethylolethylquinoline.

2-Dimethylolmethyl-3-methylquinoline.

Dimethylpentadecylcarbinol.

1:3-Dimethyl*cyclo*pentanol.

Dimethylpinacene.

Dinaphthapyranol.

Dinaphthaxanthlydiol.

Dinaphthylene glycol.

2:2'-Diphenol.

Diphenylacetylenecarbinol.

Diphenyl-*p*-anisylcarbinol.

$\alpha\epsilon$ -Diphenyl- $\alpha$ -pentanol.

Dipicraminophenol.

2:5-Dipropoxyquinol.

Durylene glycol.

Erythritols.

Ethanolmethylamine.

Ethyl alcohol.

Ethylcatechol.

Ethylene glycol.

Ethylphenols.

3-Ethylpiperidyl-4-ethanol.

3-Ethylpyridyl-4-ethanol.

3-Ethyl-4-pyridylpropanediol.

Eugenol.

*iso*Eugenol.

Fenchyl alcohol.

Furfuryl alcohol.

$\alpha$ -Furfuryl- $\beta$ -octinyl alcohol.

$\alpha$ -Furfuryl- $\beta$ -octinylcarbinol.

Furfurylphenylacetylenecarbinol.

Geraniol.

Gluco-*o*-hydroxyphenylethylcarbinol.

Glycerol.

Guaiaacol.

$\gamma$ -*iso*Heptanol.

Heptylene glycol.

Hexahydroxydiphenyl.

**Alcohols and Phenols. See :—**

$\beta$ -Hexanediol.  
 Hexyl alcohols.  
 Hexylene glycol.  
*p-cyclohexylphenol*.  
 Hydro- $\alpha$ -anthrol.  
 Hydrobenzoin.  
 Hydroquinizarol.  
*p*-Hydroxybenzyl alcohol.  
 1- $\alpha$ -Hydroxybenzyl-4-methylcyclohexanol-2.  
 4- $\alpha$ -Hydroxybutyl-1:3-dimethylbenzene.  
 2- $\alpha$ -Hydroxybutyl-1:3:5-trimethylbenzene.  
 1-Hydroxycamphene.  
 Hydroxy- $\psi$ -cumyl alcohols.  
 Hydroxy- $\psi$ -cumylene *m*-glycol.  
 Hydroxydibenzylanthracene.  
 $\alpha$ -Hydroxydihydroisoeugenol.  
 7-Hydroxy-2-*p*-dimethylanilinonaphthalene.  
 4- $\alpha$ -Hydroxyethyl-1-ethylbenzene.  
 4- $\alpha$ -Hydroxyethyl-1-mono- and -1:3-dimethylbenzenes.  
 Hydroxyethylnitrocarbamide.  
 $\alpha$ -Hydroxy-*p*-ethylphenol.  
 $\alpha$ -Hydroxyhexadecyl-1:3-di- and -1:3:5-tri-methylbenzenes.  
 Hydroxyhydroanthranol.  
 Hydroxymesitylene.  
 $\alpha$ -Hydroxy- $\beta$ -methoxydihydroisoeugenol.  
 Hydroxyphenanthrenes.  
 Hydroxyphenoxozone.  
 7-Hydroxy-2-phenyl-1:4-benzopyranol.  
 7-Hydroxy-2-phenyl-4-benzylidene-1:4-benzopyranol.  
 7-(or 5-)Hydroxy-2-phenyl-4-benzylidene-5-(or 7-)methyl-1:4-benzopyranol.  
*o*-Hydroxyphenylethylcarbinol.  
 Hydroxyphenylpyridazine.  
 2-Hydroxy-3-phenylquinoxaline.  
 4- $\alpha$ -Hydroxypropyl-1-methylbenzene.  
 2- $\alpha$ -Hydroxypropyl-1:3:5-trimethylbenzene.  
 Hydroxytetraphenylmethane.  
 2-Hydroxy-1:3:5-trimethylbenzene.  
*p*-Hydroxytriphenylcarbinol.  
*p*-Hydroxytriphenylmethane.  
 Hydroxy-xylene.  
*d*-Linalol.  
 Mannitol.  
 Menthol.  
 Menthylcarbinol.  
 Menthyl glycol.  
 2:3-Methoxynaphthol.  
 3-Methoxyphenol.  
 7-Methoxy-2-phenyl-1:4-benzopyranol.

**Alcohols and Phenols. See :—**

7-Methoxy-2-phenyl-4-benzylidene-1:4-benzopyranol.  
 7-(or 5-)Methoxy-2-phenyl-4-benzylidene-5-(or 7-)methyl-1:4-benzopyranol.  
*p*-Methoxytriphenylcarbinol.  
 Methyl alcohol.  
*m*-Methylbenzenyl-*p*-amino-*m*-thioxylenol.  
 Methyl*d*i*b*romoxyloquinol.  
 Methylenebisdimethylphloroglucinol.  
 Methylenehydrotolylcarbinol.  
 1-Methyl-3-ethylcyclopentanol-3.  
 Methylheptenol.  
 Methyl- $\beta$ -heptylcarbinol.  
 Methylheptylcarbinol.  
 Methylnonylcarbinol.  
 Methyl- $\beta$ -octylcarbinol.  
 2- $\alpha$ -Methylolethyl-3-methylquinoline.  
 $\beta$ -Methylpentane- $\beta\delta$ -diol.  
 Methylcyclopentanols.  
 Methylphloroglucinol.  
 Methylpropylcarbinol.  
 $\epsilon$ -Methyl- $\beta$ -isopropyl- $\alpha\gamma$ -hexylene glycol.  
 1-Methyl-4- $\psi$ -quinol.  
 Naphthols.  
 Noninyl alcohol.  
 Nonyl alcohol.  
 Octenyl alcohol.  
 Octyl alcohols.  
 Octylene glycols.  
 Pentaerythritol.  
 Phenanthraquinol.  
 2-Phenanthrol.  
 Phenol.  
 Phenols.  
 $\psi$ -Phenols.  
 Pheno- $\alpha$ -naphthaxanthhydrol.  
 Phenylacetylenemethylcarbinol.  
 5-Phenyl-3:5-dimethylphenonaphthacridol.  
 $\alpha$ -Phenyl- $\beta$ -heptyl alcohol.  
 1-Phenyl-3-methylbenziminazoleol.  
 Phenylmethylpropylcarbinol.  
 $\alpha$ -Phenyl- $\beta$ -octyl alcohol.  
 Phloroglucinol.  
 Phytosterol.  
 Pinacone.  
 Propyl alcohols.  
*cyclo*Propyldimethylcarbinol.  
 Propylene glycol.  
 Puleol.  
 Pyridyl*d*ichlorohydroxyquinol.  
 2-Pyridylmethylcarbinol.  
 2-Pyridylpropanediol.  
 Pyrodymopinacol alcohol.  
 Pyrogallol.  
 Quinol.  
 $\psi$ -Quinols.  
 Resorcinol.

**Alcohols and Phenols.** See:—

- Rhamnitol.
- Sabinene alcohol.
- Saligenin.
- Sitosterol.
- Storesinol.
- Styresinol.
- Styrylmethylcarbinol.
- Terpene alcohols.
- $\Delta^{8,9}$ -Terpen-1-ol.
- Terpineols.
- Tetra-acetylgluco-*o*-hydroxyphenyl-ethylcarbinol.
- Tetra-acetylmannitol.
- Tetramethyldiaminobenzhydrol.
- 1:3:4:5-Tetramethylbenziminazoleol.
- Thymol.
- Toluquinol.
- p*-Tolylamino-*m*-hydroxybenzyl alcohol.
- Trianisylcarbinol.
- sec*Tricapryl alcohol.
- 1:8:9-Trihydroxyhexahydrocymene.
- 2:3:8-Trihydroxynaphthalene.
- 1:8:9-Trihydroxyterpane.
- Trihydroxyterpineol.
- 3:5:5-Trimethyl- $\Delta^{2,6}$ -dihydrocatechol.
- Trimethylenecarbinol.
- 2:4:4-Trimethylcyclohexanol.
- Triphenylcarbinol.
- Tripropylcarbinol.
- Undecane- $\beta\gamma$ -diol.
- Undecyl alcohol.
- p*-Vinylphenol.
- Xanthhydrol.
- Xylenols.
- Xyloquinhydrone.
- Xyloquinols.

**Alcohols.** See also Glycols.

- Paraldehyde**, action of, on *o*-nitroso-benzoic acid (CIAMICIAN and SILBER), A., i, 378.
- Aldehydehydrazones**, nitro-, reduction of (BAMBERGER and FREI), A., i, 404.
- Aldehydes**,  $R \cdot CHMe \cdot CHO$ , preparation of (BOUGAULT), A., i, 452.
- formation of, by the electrolysis of salts of the fatty acids (HOFER and MOEST), A., i, 736.
- formation of, from  $\beta$ -chloro-alcohols (KRASSUSKY), A., i, 425.
- formation of, from hydrochlorides of imino-ethers (HENLE), A., i, 790.
- formation of, from haloid derivatives of olefines (KRASSUSKY), A., i, 261.
- synthesis of (BOUVEAULT and WAHL), A., i, 532.
- isolation of (CHEMISCHE FABRIK VON HEYDEN), A., i, 376; (NEUBERG and NEIMANN), A., i, 572; (FREUND and SCHANDER), A., i, 696.

- Aldehydes**, behaviour of, towards Tesla rays (KAUFFMANN), A., ii, 191.
- reduction-potential of (BAUR), A., i, 77.
- decomposition of (NEF), A., i, 8.
- interaction of, with acid chlorides (LEES), P., 1902, 213.
- action of acid chlorides on, in presence of zinc chloride (DESCUDÉ), A., i, 149, 339, 451.
- condensation of, with ethyl cyanoacetate (GUARESCHI), A., i, 819.
- action of, on hydramines (KNORR and MATTHES), A., i, 56.
- action of, on hydrazobenzene and its substitution derivatives (RASSOW and RÜLKE), A., i, 404.
- condensation of, with acetylenic hydrocarbons (MOUREU and DESMOTS), A., i, 289.
- condensation of, with methylamine and ethylamine (ANDREE), A., i, 210.
- additive compounds of, with phenylhydrazine-*p*-sulphonic acid (BILTZ, MAUE, and SIEDEN), A., i, 571.
- action of, on 6-phenyl-2-methylpyridine (THORAU SCH), A., i, 234; (ÖLLENDORFF), A., i, 827.
- test for, in urine (RIEGLER), A., ii, 585.

**Aldehydes of the acetic series**, synthesis of, by means of nitromethane (BOUVEAULT and WAHL), A., i, 591.

- Aldehydes, aromatic**, influence of intranuclear substituents on the reactivity of (POSNER), A., i, 622.
- action of solid alkalis on (RAIKOW and RASCHTANOW), A., i, 721.
- condensation of, with amines (DIMROTH and ZOEPPRITZ), A., i, 292.
- condensation of, with malononitrile (WALTER), A., i, 373.
- condensation of, with nitromethane (BOUVEAULT and WAHL), A., i, 682.
- condensation of, with pyrroles and ethereal pyrrolecarboxylates (FEIST), A., i, 490; (VORLÄNDER), A., i, 562.
- acetates from (FARBENFABRIKEN VORM. F. BAYER & Co.), A., i, 102.

**Aldehydes.** See also:—

- Acetaldehyde.
- Acetaldol.
- Aldol,  $C_{13}H_{16}O_2$ .
- Anisaldehyde.
- Aromadendral.
- Benzaldehyde.
- Benzylidenedivanillin.
- Berberinaldehyde.
- Bromal.
- Butaldehydes.
- Camphenaldehyde.
- Carbonylchloroaldehydes.
- Chloral.



**Aldehydes.** See:—

- Cinnamaldehyde.  
*cyclo*Citrals.  
 Cuminaldehyde.  
*n*-Decaldehyde.  
 3:4-Dimethoxyhydratropaldehyde.  
 Dimethoxymethylenedioxyhydratropaldehyde.  
*p*-Dimethylaminobenzaldehyde.  
 Diphenylacetaldehyde.  
 $\alpha\beta$ -Diphenyl- $\alpha\alpha$ -diphenylthioethane-2-al.  
*m*-Ethoxybenzaldehyde.  
 Formaldehyde.  
 Furfuraldehyde.  
 Heptaldehyde.  
*iso*Hexaldehyde.  
 Hydroxyaldehydes.  
 Hydroxybenzaldehydes.  
 Hydroxymethylsalicylaldehyde.  
 Malonic dialdehyde.  
 Mesoxalic semi-aldehyde.  
 Metaformaldehyde.  
*o*-Methoxybenzaldehyde.  
*p*-Methoxyhydratropaldehyde.  
 Methylglycerinaldehyde.  
 2-Methyl-5-*isopropyl*-tetra- and -hexahydrobenzaldehyde.  
 Methylsalicylaldehyde.  
*n*-Nonaldehyde.  
*n*-Octaldehyde.  
 CEnanthaldehyde.  
 Paraldehyde.  
 Paraldol.  
 $\beta$ -Phenylpropaldehyde.  
 Piperonal.  
 8-Quinolinaldehyde.  
 Succinaldehyde.  
 Succindialdehyde.  
 Tolualdehydes.  
 2:2:4-Trimethyl-tetra- and -hexahydrobenzaldehyde.  
 Trioxymethylene.  
*iso*Valeraldehyde.  
 Vanillin.
- $\beta$ -Aldehydic acids**, optically active esters of (LAPWORTH and HANN), T., 1491, 1499; P., 1902, 144, 145.
- Aldehydotrichloroquinodichloride**, and its oxime and semicarbazone (BILTZ and KAMMANN), A., i, 162.
- p*-**Aldehydohydrazobenzene**, anilide of (ALWAY), A., i, 697.
- 2-Aldehydo-5:6-methoxybenzoyl chloride** (*opicanic chloride*) (MEYER), A., i, 31.
- 8-Aldehydonaphthoic acid** (*naphthaldehydic acid*), and its methyl ester (ZINK), A., i, 159.
- condensation of, with acetone and with acetophenone (ZINK), A., i, 34.

- Aldol**,  $C_{13}H_{16}O_2$ , from cinnamaldehyde and isobutaldehyde (MICHEL and SPITZAUER), A., i, 292.
- Aldol** (*acetaldol*), viscid, and **Paraldol** (NOWAK), A., i, 260.
- Alga**, green, assimilation of carbon by a (CHARPENTIER), A., ii, 419.
- Algæ**, the wax of, and its relation to petroleum (KRAEMER and SPILKER), A., i, 333.
- fresh-water, effect of methylal on (BOUILHAC), A., ii, 40.
- Alinit**. See Agricultural Chemistry.
- Alizarin methyl ether** (GRAEBE and ADERS), A., i, 43.
- Alizarin**,  $\alpha$ -amino-, acetyl and benzoyl derivatives of (SCHULTZ and ERBER), A., i, 299.
- $\beta$ -amino-, dibenzoyl derivative of (SCHULTZ and ERBER), A., i, 299.
- bromo- $\beta$ -amino- (BADISCHE ANILIN- & SODA-FABRIK), A., i, 477.
- Alkali**, reaction of, with chloral hydrate (BÖTTGER and KÖTZ), A., i, 659.
- free, titration of, in presence of nitrites (ARNDT), A., ii, 630.
- Alkali carbonates**, action of higher fatty acids on (KLIMONT), A., i, 132.
- hydroxides, silicates and sulphates, analysis of mixtures of (LUNGE and LOHÖFER), A., ii, 105.
- chlorides, electrolysis of, with carbon anodes (SPROESSER), A., ii, 193.
- electrolysis of, with platinised electrodes (FOERSTER and MÜLLER), A., ii, 640.
- electrolysis of solutions of, current and energy efficiencies obtained in the (FOERSTER and MÜLLER), A., ii, 240.
- decomposition of (VOLNEY), A., ii, 70.
- compounds of, with aluminium chloride (BAUD), A., ii, 142.
- cyanamides (DEUTSCHE GOLD- & SILBER-SCHNEIDE-ANSTALT), A., i, 354.
- hydroxides, behaviour of picric acid towards boiling (WEDEKIND and HAEUSSERMANN), A., i, 367.
- or hydrogen carbonate, estimation of, in presence of normal alkali carbonate (RIDENOUR), A., ii, 49; (NORTH and LEE), A., ii, 356.
- metals, peroxides of (CALVERT), A., ii, 10.
- thiocyanates, action of mercuric bromide on the (GROSSMANN), A., i, 749.
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**Alkalimetry**, gasometric method for (RIEGLER), A., ii, 696.

**Alkaline-earth** metals, arsenides of (LEBEAU), A., ii, 395.  
sulphides, phosphorescence of (DE VISSER), A., ii, 237.

**Alkali-proteid**, globulin as (WOLFF and SMITS), A., i, 67.

**Alkalis**, normal, in acidimetry (JUNGCLAUSSEN), A., ii, 46.

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**Alkaloidal salts**, extraction of, from aqueous solutions (SPRINGER), A., ii, 542.

**Alkaloids** of *Argemone mexicana* (SCHLOTTERBECK), A., ii, 101.

of *Corydalis cava* (GADAMER, ZIEGENBEIN, and WAGNER), A., i, 306, 391.

of *Solanum chenopodium* (SAGE), A., ii, 282.

of *Stylophorum diphyllum* (SCHLOTTERBECK and WATKINS), A., ii, 101.

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separation of, from urine (DOMBROWSKI), A., ii, 633.

**Alkaloids**. See also:—

Adenine.  
Anhydrolupinine.  
Arecaidine.  
Arecoline.  
Arginine.  
Atropine.  
Atroscine.

**Alkaloids**. See:—

Benzoyllupinine.  
Berberine.  
Brucidine.  
Brucine.  
Caffeine.  
Canadine.  
Cevadine (*cevatrine*).  
Choline.  
Cinchonidine.  
Cinchonifine.  
Cinchonine.  
*allo*Cinchonine.  
*iso*Cinchonines.  
Cinchotine.  
Cinnamylquinine.  
Cocaine.  
*l*-Coniine.  
*iso*Coniine.  
*iso*Corybulbine.  
Corycavamine.  
Corycavine.  
Corydaldine.  
Corydaline.  
Corydine.  
Corytuberine.  
Cotarnine.  
Creatine.  
Creatinine.  
Cynoglossine-Riedel.  
Cystine.  
Dehydrocorydaline.  
Dihydroberberine.  
Dimethyl-lupuline.  
3:8-Dimethylxanthine.  
Diphylline.  
Eegonine.  
Epiosine.  
8-Ethylxanthine.  
Eucaines.  
Guanine.  
Histidine.  
Hydroxycinchotine.  
Hyosine.  
Ibogaine.  
Ibogine.  
Ipohine.  
Laudanine.  
*d*-Lupanine.  
Lupinine.  
Lysatinine.  
Lysine.  
*allo*Meroquinene.  
1-Methyl-*l*-coniine.  
*n*-Methylgranatanine.  
Methyl-lupuline.  
Methylmorphimethines.  
8-Methylxanthine.  
Morphigenine.  
Morphine.  
Nicotianine.  
Nicotine.

**Alkaloids.** See:—

Oscine.  
 Oxycotarnine.  
 Oxymorphone.  
 Physostigmine.  
 Pilocarpine.  
 8-*iso*Propylxanthine.  
 Protopine.  
 Pyridinecholine.  
 Quinidine.  
 Quinine.  
 Salicylylquinidine.  
*i*-Scopolamine.  
 Strychnidine.  
 Strychnine.  
 Stylophine.  
 Tanacetine-Riedel.  
 Tetrahydrobrucine.  
 Tetrahydrostrychnine.  
 1:3:8-Trimethylxanthine.  
 Tropine.  
 Veratrine.  
 Yohimbine.  
 Xanthine.  
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**Alkyl bromides**, velocity of combination of, with heterocyclic compounds (MENSCHUTKIN), A., ii, 493.

**Alkylacetylacetones**, action of, on diazonium and tetra-azonium chlorides (FAVREL), A., i, 508.

**Alkylamines**, microchemical detection of (BEHRENS), A., ii, 634.

**Alkylcyanoacetamides**, preparation of (GUARESCHI), A., i, 819.

**Alkyl groups**, influence of, on the activity of halogenised benzenes (KLAGES and STORP), A., i, 670.

**Alkylhydrazines**, preparation of (STOLLÉ), A., i, 57.

**Alkylmalonic acid**, esters, action of ammonia on (FISCHER and DILTHEY), A., i, 269.

action of ethyl chlorofumarate on (RUHEMANN), T., 1212; P., 1902, 181.

**Alkyloxy-acids**, reactivity of (V. WALTHER), A., i, 528.

**Alkyloxyl group**, velocity of substitution of a halogen by an, in aromatic halogen nitro-compounds (LULOFS), A., i, 87.

**Alkyltricarballic acids**, synthesis of (BONE and SPRANKLING), T., 29; P., 1901, 215.

**Allantoin**, excretion of (MENDEL), A., ii, 276.

**Allophane** (?) from Kansas (ROGERS), A., ii, 163.

**Allophanic acid**, sodium derivative of the sodium salt (EPHRAIM), A., i, 269.

**Alloys**, formation of, and cathodic polarisation (COHEN), A., ii, 2.

**Alloys**, potentials of, and the formation of superficial layers (HABER and SACK), A., ii, 441; (HABER), A., ii, 638.

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**Allylamine**, bromo- (RUDZICK), A., i, 24.

**$\beta$ -Allylbenzene**, bimolecular (KLAGES), A., i, 667.

and its bromides and glycol (TIFFENEAU), A., i, 433; (KLAGES), A., i, 667.

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**Allylmesitylene**, and its nitrosochloride (KLAGES), A., i, 612.

**1-Allyltetrahydroquinoline** and its hydrobromide (WEDEKIND), A., i, 234.

**Aloes**, Barbados, soluble hydroxy-anthraquinone glucoside in (AWENG), A., i, 814.

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**Aloin**, detection of (BOURQUELOR), A., ii, 483.

**Aloins**, constitution of (LÉGER), A., i, 685.

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**Aloin red** (SCHAER), A., i, 168.

**Altaite** from Tolueme Co., California (EAKLE and SCHALLER), A., ii, 213.

**Aluminium**, pasty condition of, near its melting point (GRANGER), A., ii, 608.

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**Aluminium alloys** (CAMPBELL and MATHEWS), A., ii, 399.

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**Aluminium bromide**, compounds of, with bromine and carbon disulphide (PLOTNIKOFF), A., ii, 21.

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**Amenylbenzene**, and its dibromide (KLAGES), A., ii, 669.

**Amides**, hydrolysis of, by ferments (GONNERNANN), A., i, 512.

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**Amidogen**, replacement of the diazo-group by (WACKER), A., i, 698.

**Amine**,  $C_8H_{17}N$ , from the reduction of  $\beta$ -methylcyclopentanemethylidenecarboxylonitrile (SPERANSKI), A., i, 342.

**Amines**, formation of, from amides (GRAEBE and ROSTOVZEFF), A., i, 663.

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action of, on phthalic chloride (KUHARA and FUKUI), A., i, 34.

acetylation of (PAWLEWSKI), A., i, 209.

compounds of, with *p*-chlorophenylacetic acid, amide, and nitrile (v. WALTHER and RAETZE), A., i, 466.

compounds of, with sodium tetraazoditolylsulphonate (SEYEWETZ and BIOT), A., i, 509.

primary, in which the para-position is occupied, condensation of, with tetramethyldiaminobenzhydrol (GUYOT and GRANDERYE), A., i, 398.

mono- and di-alkylated (BADISCHE ANILIN- & SODA-FABRIK), A., i, 91.

thiosulphates of (WAHL), A., i, 145.

benzenoid, relation between physical constants and constitution in (HODGKINSON and LIMPACH), A., i, 90.

fatty, crystallography of platinichlorides of (RIES), A., i, 747.

primary, dithiocarbamic esters from (DELÉPINE), A., i, 595.

test for (FENTON), P., 1902, 244.

primary and secondary, aminobenzyl cyanides and iminobenzoyl cyanides from (SACHS and GOLDMANN), A., i, 780.

tertiary,  $C_9H_{18}N$ , from trimethylpiperidine (b. p.  $166^\circ$ ) quaternary iodides (WALLACH and GILBERT), A., i, 80.

action of cyanogen bromide on (v. BRAUN and SCHWARZ), A., i, 365.



**Amines**, tertiary, action of, on esters of organic acids (WILLSTÄTTER and KAHN), A., i, 662.

**Amines.** See also :—

Acetylenetriphenyltriamine.  
Acetyl-mono- and -di-glucosamine.  
Acetyl-*m*-hydroxyphenyl-*p*-tolylamine.  
Acetylmethylene-*p*-phenylenediamine.  
Acetylphenylhydroxylamine.  
Acylamines.  
Alkylamines.  
Allylamine.  
Anhydro-acetyl- and -benzoyl-9-amino-10-hydroxyphenanthrenes.  
Anhydroformaldehydeaniline.  
Aniline.  
9-Anilino-3:5-*d*-diaminophenazothionium chloride.  
 $\epsilon$ -Anilinoamylphthalimide.  
Anilinoitraconanil.  
Anilino-dimethylpyrimidines.  
2-Anilinohydrocarbostyryl.  
 $\alpha$ -Anilinoethylsuccinamides.  
Anilino- $\beta$ , $\beta$ -naphthaphenazine.  
Anilino-naphthaphenazothionium anhydride.  
3-Anilino-phenazothionium salts.  
3-Anilino-phenazoxonium salts.  
Anilino-phenylmethylene-camphoranil.  
6-Anilino-3-phenyl-5-methylpyridazine.  
3-Anilino-4-phenyl-5-triazolone.  
Anisidines.  
Anisole, *diamino*-.  
Anthragallolamine.  
Anthraquinone, amino-.  
Arylamines.  
Benzaldehydeanilines.  
Benzaldehyde- $\beta$ -naphthylamine.  
Benzaldehydesemicarbazine-2:4-nitroamine.  
Benzaldoxime, *diamino*-.  
Benzamidine.  
Benzidine.  
Benzophenoneaniline.  
Benzoyl-*o*-aminodiphenylamine.  
Benzoyldiphenylbenzenylamidine.  
Benzoyl-*o*-flavaniline.  
Benzylalkylanilines.  
Benzylamine.  
Benzylaniline.  
Benzyl cyanides, amino-.  
Benzyl-di-ethyl- and -propyl-amines.  
Benzylethylaniline.  
Benzylidene-*m*-aminoacetophenone, *m*-amino-.  
Benzylideneaniline.  
Benzylidenebenzidine.  
Benzylidenedimethyl-*p*-phenylenediamine.

**Amines.** See :—

Benzylideneglucosamine.  
Benzylidene-methyl- and -ethylamines.  
Benzylidene- $\alpha$ -naphthylamine.  
Benzylidene-*m*-nitroaniline.  
Benzylidenetoluidines.  
Benzyl- $\alpha$ -naphthylamine.  
Benzyl-*p*-nitroaniline.  
Benzyl-*o*-toluidine, 4-amino-.  
Benzyl-*p*-toluidine.  
Bisdinaphthaxanthoneamine.  
Bis-2:4-*d*-nitrobenzylidenebenzidine.  
Butanolamines.  
*iso*Butyryl-*o*-flavaniline.  
Camphidine.  
*iso*Camphoramine.  
 $\alpha$ -Carbaminethiobutyranilide.  
 $\alpha$ -Carbaminethiolactanilide.  
Carbonyl-2:2'-*diamino*-4:4'-dimethyldiphenyl.  
Carbonyl-2:2'-*diaminodiphenyl*.  
Chitosamine.  
Cinnamylidene-methyl- and -ethylamines.  
Cumylidene-methylamine and -ethylamine.  
Cumyl-methylamine and -ethylamine.  
*iso*Dehydrothio-*m*-xylylidine.  
Desylamine.  
2:4'-Diacetoxycarbonylbenzophenoneaniline.  
Diamines.  
3:4-Dianilino- $\beta$ -naphthaphenazothionium anhydride.  
Dianilino-phenazothionium chloride.  
3:9-Dianilino-phenazoxonium chloride.  
Di-*o*-anisylguanidine, amino-.  
Dibenzoyl-*p*-aminodiphenylamine.  
Dibenzoyl-*o*-toluidine.  
Dibenzylallylamine.  
Dibenzylamine.  
Dibenzylhydrazine, *as-o-diamino*-.  
Dicarbanilinocarbaminodixylylmethylenediamine.  
Dicarbanilindiphenylmethylenediamine.  
Di- $\psi$ -cumylformamidine.  
3:4-Diethyl-*diaminotoluene*.  
Diethylaniline.  
3:3'-Diethyldiphenyl, 4:4'-*diamino*-.  
Diethyl- $\beta$ -naphthylamine.  
Diethyl-*o*-toluidine, 4-amino-.  
Dihydrocampholene,  $\alpha$ -amino-.  
Dihydroxybenzylideneaniline.  
Di-*p*-hydroxydiphenyl-*m*-phenylenediamine.  
Di-9-hydroxyphenanthryl-10-amine.  
3:7-Dimethylacridine, 2:8-*diamino*-.  
*p*-Dimethylaminoacetophenone, *o*-amino-.  
*p*-Dimethylaminobenzylidene-*m*-aminoacetophenone.

**Amines.** See :—

*p*-Dimethylaminobenzylidene-*p*-nitroaniline.  
 Dimethyl-*p*-diaminodiphenylamine.  
 Dimethyldiaminohexene.  
 Dimethyl-*p*-amino-*m*- and -*p*-hydroxydiphenylamine.  
 2-Dimethylamino-12-methylpheno-1:2-naphthaeridinium salts.  
 3'-Dimethylaminopheno-3-amino-oxylazines.  
 2-Dimethylaminopheno-1:2-naphthaeridine.  
*as*-Dimethyldiaminophenotolazoxonium chlorides.  
 Dimethylaminotolaminonaphthazoxonium hydride.  
*as*-Dimethyldiaminotonaphthazoxonium chlorides.  
 3:4-Dimethyldiaminotoluene.  
 Dimethylaniline.  
 Dimethyldiethyldiaminophenotolazoxonium iodide.  
 4:4'-Dimethyldiphenyl, 2:2'-diamino.  
 Dimethylhydroxyethylamine.  
 Dimethyl- $\beta$ -naphthylamine.  
 1:3-Dimethyl-*m*-phenylenediamine.  
 2:4-Dimethylpyridine, 6-amino.  
 Dimethylpyrimidines, amino-.  
 2:4-Dimethylpyrimidylethylene-diamine.  
 Dimethyl-*o*-toluidine, 4-amino.  
 Dimethyltoluidines.  
 $\alpha$ -Dinaphthylamine.  
 Di- $\beta$ -naphthylformamidine.  
 Di- $\beta$ -naphthylguanidine, amino-.  
 Diphenyl, 2:2'-diamino-.  
 Diphenylamine.  
 Diphenyltetraaminobenzene, di-amino-.  
 Diphenylchlorophenylene-*p*-diamines.  
 Diphenylformamidine.  
 Diphenylguanidine, amino-.  
 Diphenylmethane, diamino-.  
 Diphenylmethylamine.  
 Diphenylmethylenediamine.  
 Diphenyl-4:6-dinitro-1:3-phenylene-diamine, diamino-.  
 Diphenyloxyformamidine.  
 Diphenyl-*p*-tolylaminotriazole.  
 4:4-Dipyrimidylethylenediamine.  
 Dithymolylamine.  
 Di-*p*-tolyldiaminodihydroxydiphenylmethane.  
 Ditolylformamidine.  
 Di-*p*-tolylguanidine, amino-.  
 Ditolylmethylenediamines.  
 Ditolylmethylenedihydroxyamines.  
 Di-*p*-tolylloxyformamidine.  
 Dixylylformamidines.  
 Dixylylmethylenediamine.  
 Dixylylmethylenedihydroxyamines.

**Amines.** See :—

Dixylyloxyformamidines.  
 Ethanolmethylaniline.  
 Ethenyl-3:4-tolylenediamine.  
 Ethylamine.  
 Ethylaniline.  
 Ethylenediamine.  
 Ethyl- $\beta$ -naphthylamine.  
*m*-Ethyltoluidine.  
*m*-Ethyltolenylenediamines.  
 Fluorene, amino-.  
 Fluorindine,  $C_{26}H_{21}N_5Cl_4$ .  
 Formamidines.  
*N*-Formyl- $\beta$ -phenylhydroxylamine.  
 Furfurylidene-methylamine and -ethylamine.  
 Furfuryl-methylamine and -ethylamine.  
 Glucosamine.  
 Glycocyamidine.  
 Hexahydrobenzylamine.  
 Hexahydro-*m*-tolylenediamine.  
 Hexahydro-*m*-xylylenediamine.  
*iso*Hexane,  $\beta\beta$ -diamino-.  
 Homocamphanylaniline.  
 Homocamphenylaniline.  
 Hydrindamine.  
 Hydrocinnamyl-methyl- and -ethylamines.  
*p*-Hydroxybenzaldehydeaniline.  
 Hydroxy- $\psi$ -cumylanilines.  
 5-Hydroxydimethyl- $\alpha$ -naphthylamine.  
 4-Hydroxydiethyl-*o*-toluidine.  
 4-Hydroxydimethyl-*o*-toluidine.  
 Hydroxydiphenylamine.  
 Hydroxylamine.  
 3-Hydroxymethyl-2-aminobenzylidene-*p*-nitroaniline.  
 9-(or 10)-Hydroxyphenanthrene, amino-.  
 5-*p*-Hydroxyphenyl-2-aminomethylpheno- $\alpha\beta$ -naphthaeridine.  
*p*-Hydroxyphenylethylamine.  
 2- $\beta$ -Hydroxy- $\beta$ -phenylethylpyridine, *p*-amino-.  
 3-Hydroxy-2-phenyl-6-(or 7)-methylquinoxaline, amino-.  
*p*-Hydroxyphenyl- $\alpha$ -naphthylamine.  
*p*-Hydroxyphenylpyridazine, amino-.  
 Hydroxyphenylquinoxalines, amino-.  
*m*-Hydroxyphenyl-*p*-tolylamine.  
 Leucauramines.  
 Lophine, amino-.  
*p*-Methoxy-2-stilbazole, amino-.  
 Mesitylene, triamino-.  
 Methylamine.  
 2-Methylaminobenzyl-*p*-nitroaniline.  
*o*-Methylaminodiphenylamine.  
 Methylaniline.  
 Methyl-bromo- and -chloro-ethylamines.  
 Methyleneaniline.

**Amines. See:—**

Methylenebis(aniline).  
 Methylenediamine.  
 3:2-Methyleneimino-benzyl- and -benzylidene-*p*-nitroanilines.  
 Methylheptenylamine.  
*p*-Methylhexahydrobenzylamine.  
 4-Methylpheno- $\beta$ -naphthacridine, 3-amino-.  
 2-Methyl-5-*isopropyl*hexahydrobenzylamine, -aniline, -dimethylamine, and -diethylamine.  
 4-Methylpyrimidine, amino-.  
 4-Methylstilbazole, *p*-amino-.  
 Methyltoluidine.  
 1-Naphthol, 8-amino-.  
 Naphthylamines.  
 $\alpha$ -Naphthyl dimethylamine.  
 Naphthylenediamines.  
 $\alpha$ -Naphthylmethylamine.  
 $\beta$ -Nonylamine.  
 2:4:2':4'-Octamethyltetra-amino-ditolyl-5:5'-methane.  
 3-Oxyaminophenylphenazonium anhydride.  
 Pentanolamines.  
 Phenanthrene, amino-.  
 Phenanthrylamines.  
 Phenazoxone, 3:5-*d*iamino-.  
 Phenetidine.  
 Pheno- $\alpha$ -aminocycloheptane.  
 Phenol, *o*-amino-.  
 Phenonaphthacridine, amino-.  
 Phenoxozone, *d*iamino-.  
 Phenyl*d*iaminophenazine, amino-.  
 Phenyldicarbylamine.  
 Phenyl dimethyl*d*iaminophenotolazonium chloride.  
 Phenylenediamines.  
 Phenylenedicarbylamines.  
*m*-Phenylene-1:3-dimethyl*d*initroamine.  
 $\beta$ -Phenylethylamine.  
 Phenylcyclohexane, *p*-amino-.  
 Phenylhydroxylamine.  
 Phenyl-2:4-lutidylalkine, *p*-amino-.  
 5-Phenyl-3-methyl-5:12-dihydrophenonaphthaeridine, 2-amino-.  
 5-Phenyl-3-methylphenonaphthaeridine, 2-amino-.  
 Phenylmethylnitroamine.  
 5-Phenyl-2-mono- and -di-alkylamino-3-methylphenonaphthaeridines.  
 5-Phenyl-2-mono- and -di-alkylamino-phenonaphthaeridines.  
 Phenylnitroamine.  
 Phenyl-2-phenanthrylamine.  
 5-(or 3-)Phenylpyrazole, amino-.  
 1-Phenyl-3-*p*-tolyl oxyformamidine.  
 Phthalylhydroxylamine.  
 Phthalyl-2:4-tolylenediamines.  
 Pilocarpine, 1-amino-.

**Amines. See:—**

$\epsilon$ -Piperidinoamylamine.  
 Piperonylene-methyl- and -ethylamines.  
 Piperonyl-methyl- and -ethylamines.  
 Pyrazole, 4-amino-.  
 Pyridine, amino-.  
 Pyrimidine, amino-.  
 Pyrogallolaldehydeaniline.  
 Pyrrolidines, amino-.  
 Resorcinolaldehydeaniline.  
 Salicylaldehydeaniline.  
 Stilbazole, amino-.  
 4:4'-Tetraethyl*d*iaminodiphenylmethane.  
 4:4'-Tetramethyl*d*iaminodiphenylmethane, 2-amino-.  
 2:8-Tetramethyl*d*iamino-10-methylacridinium nitrate.  
 Tetramethyl*d*iaminophenotolazonium chloride.  
 Tetramethyl*d*iaminophenotoloxazine.  
 2:4-Tetramethyl*d*aminotoluene.  
 4:6-Tetramethyl*d*iamino-*m*-xylene.  
 Tetramethyl-*m*-phenylenediamine.  
 2:2:5:5-Tetramethylpyrrolidine, 3-amino-.  
 Tetraphenylhydrazodicarbonamidine.  
 Thujamenthylamine.  
 Toluidines.  
*p*-Tolyl dicarbylamine.  
 Tolylenediamines.  
 6-Tolylhydroxylamine.  
*p*-Tolyl- $\alpha$ -naphthylamine.  
 3-*p*-Tolylpyridazine, amino-.  
 Tribenzylamine.  
 1:2:3-Trihydroxybenzylideneaniline.  
 3:7-10-Trimethylacridinium salts, 2:8-*d*iamino-.  
 5-(or 3-)Trimethylaminophenylpyrazole.  
 Trimethylenemethane, amino-.  
 Trimethylenetriethyltriamine.  
 2:2:4-Trimethylhexahydrobenzylamine.  
 Triphenylmethylamine.  
 Triphenylmethylamylamine.  
 Triphenylmethyl ethylamine.  
 Triphenylmethyl propylamine.  
 $\beta$ -Undecylamine.  
 Uraeil, 4:5-*d*iamino-.  
 Vinylamine.  
*m*-Xylene, *d*iamino-.  
 Xylenes, amino-.

**Amino-acids** from the hydrolysis of muscle (ÉTARD, A., i, 699).  
 from plants (SCHULZE and WINTERSTEIN, A., i, 595).  
 formation of (FISCHER, LEVENE, and ADERS, A., i, 512).

- Amino-acids**, discrimination between basic and acid functions in solutions of, by means of formaldehyde (SCHIFF), A., i, 85.  
 action of, on phosphotungstic acid (SCHULZE and WINTERSTEIN), A., i, 137.  
 as food material for moulds (EMMERLING), A., ii, 521.  
 racemic. See under Racemic.
- Amino-acids of the  $C_nH_{2n+1}O_2N$  series**, preparation of (KUTSCHER), A., i, 594.
- Amino-alcohols** (TORDOIR; STIÉNON), A., i, 265.  
 polyhydric, action of carbon disulphide on (MAQUENNE and ROUX), A., i, 694.
- Amino-oxime-oxalic acid** and its ethyl ester (PICKARD, ALLEN, BOWDLER, and CARTER), T., 1575.
- Amino-oximes**, reactions of (SCHIFF), A., i, 429.
- Aminosulphonic acids**, aromatic, iodo-derivatives of (KALLE & Co.), A., i, 716.
- Ammonia** in mist, hoar frost, snow and rain (CASALI), A., ii, 423.  
 synthesis of, by electricity (DE HEMPTINNE), A., ii, 450.  
 preparation of, from atmospheric nitrogen (HOYERMANN), A., i, 355.  
 physical properties of aqueous solutions of (GOLDSCHMIDT), A., ii, 15.  
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 gaseous, heat of solidification of (DE FORCRAND), A., ii, 379.  
 liquid, latent heat of solidification of (DE FORCRAND and MASSOL), A., ii, 379.  
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 solid, latent heat of fusion of (MASSOL), A., ii, 378.  
 influence of salts and other substances on the vapour pressure of aqueous solutions of (PERMAN), T., 480; P., 1901, 261.  
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- Ammonia** in the blood of geese (KOWALEWSKI and SALASKIN), A., ii, 619.  
 excretion of, in human urine (CAMERER), A., ii, 416.  
 estimation of, in waters (THOMAS and HALL; EMMERLING), A., ii, 535.  
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- Ammonio-chromium salts**. See under Chromium.
- Ammonio-cobalt salts**. See under Cobalt.
- Ammonio-copper compounds**. See under Copper.
- Ammonium**, non-existence of, at  $-80^\circ$  (MOISSAN), A., ii, 72.  
 as direct source of nitrogen for plants (KOSSOWITSCH), A., ii, 684.
- Ammonium amalgam** (MOISSAN), A., ii, 71.
- Ammonium compounds**, constitution of (WERNER), A., ii, 554.
- Ammonium salts**, thermochemical action of ammoniacal cupric oxide on (BOUZAT), A., ii, 550.  
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- Ammonium mercuric bromide**, chloride, and chlorobromide (RÂV), T., 648; P., 1902, 85.  
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 chloride and iodide, electrolysis of, in solution in liquefied ammonia (MOISSAN), A., ii, 71.  
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- nickel chromate** (BRIGGS), P., 1902, 255.
- haloids**, crystallography of (SLAVÍK), A., ii, 561.
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- Ammonium phosphates**, with cadmium, cobalt, manganese and zinc, estimation of, volumetrically (DAKIN), A., ii, 628.
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- $\psi$ -Ammonium bases** and their derivatives (HANTZSCH and HORN), A., i, 311.
- Ammonium compounds** (DECKER), A., i, 691; (DECKER, HOEK, and DJIWONSKY), A., i, 830.
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- iodides**, organic, physiological action of (JACON), A., ii, 620.
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- Amphibole** in soda-syenite from Miask (JOHNSEN), A., ii, 31.
- Amygdalin**, catalytic racemisation of (WALKER), P., 1902, 198.
- Amyl alcohol**, fermentation (BEMONT), A., i, 131.
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- iso***Amyl alcohol**, properties of mixtures of, with benzene, and with benzene and water (YOUNG and FORTEY), T., 749; P., 1902, 105.
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- Amyl alcohols**, separation of, from fusel oil (MARCKWALD), A., i, 418.
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- iso***Amylacetone**, nitroso- (BOUVEAULT and LOCQUIN), A., i, 705.
- m-iso***Amylaminobenzoic acid** and its hydrochloride and nitroso-derivative (BAUER and EINHORN), A., i, 224.
- m-iso***Amylaminohexahydrobenzoic acid** and its ethyl ester, and nitroso-derivative (BAUER and EINHORN), A., i, 224.
- iso***Amylbenzene**, *p*-iodo-, *p*-iodoso-, and *p*-iodoxy-derivatives of, and their salts (WILLGERODT and DAMMANN), A., i, 19.
- sec.***Amylbenzene** (KLAGES), A., i, 668.
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- Amylene** ( *$\beta$ -methyl- $\beta$ -butylene*)  $\beta\gamma$ -nitrosate, polymerism of (SCHMIDT), A., i, 582.
- $\beta\gamma$ -nitrosite, polymerism and desmotropism of (SCHMIDT), A., i, 581.
- $\beta\gamma$ -isomitosite, and its benzoyl and phenylcarbamide derivatives (SCHMIDT), A., i, 582.
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- $\gamma$ -Amylodextrin** from the action of barley diastase on starch (BAKER), T., 1179; P., 1902, 134.

- p*-**isoAmylphenyl** iodide containing polyvalent iodine, derivatives of (WILGERODT and DAMMANN), A., i, 19.
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- 3-Amylpyrazolone** (BONGERT), A., i, 74.
- $\beta$ -Amylsulphoneisobutyl methyl ketone** (POSNER), A., i, 297.
- $\beta$ -Amylsulphone- $\beta$ -methyl- $\beta$ -phenylethyl and  $\beta$ -Amylsulphone- $\beta$ -phenylethyl phenyl ketones** (POSNER), A., i, 297.
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*p*-Acetylchloroaminoazobenzene.

Anilinoazoacetoacetic acid.

Anilinoazobenzoylacetic acid.

Anilinobenzeneazocyanide.

Anilinobenzeneazophenylsulphone.

Anilinobenzeneazosulphonic acid.

Anisole-*ant*idiao-compounds.

Anisole-diazo-iodide.

Arylazoacetaldoximes.

Arylazoalldoximes.

*o*-Aziminobenzaldehyde.

*s-p*-Azodibenzaldehyde.

4:4'-Azophthalic acid.

5:5'-Azophthalide.

4-*p*-Azotoluenepyrazolone-3-acetic acid.

Azoxyanisole.

Azoxybenzaldehydes.

Azoxybenzaldoxime.

Azoxybenzene.

**Azo compounds**. See :—

Azoxybenzylidene-aniline and -toluidines.

Azoxynaphthalene.

1:1'-Azoxynaphthalene-di- and -tetrasulphonic acids.

Azoxyphenyl ethers.

*p*-Azoxy-*o*-toluidine.

Benzene-5-azodiamino-*m*-xylene.

Benzeneazospidinol.

Benzeneazobenzaldehyde.

Benzeneazobenzylideneaniline.

Benzeneazobromo- $\alpha$ -naphthol.

Benzeneazodichloro-*m*-phenylenediamines.

Benzeneazochlorotolylene-diamines.

Benzeneazodihydroxynaphthalene.

Benzeneazofilicyl-*n*-butanone.

Benzeneazo-*o*-hydroxyazoxybenzene.

Benzeneazomethylphloroglucinol-*n*-butanone.

Benzeneazonaphthols.

Benzeneazo- $\alpha$ -naphthylamine.

Benzeneazo- $\beta$ -naphthylauramine.

Benzeneazo-10-phenanthrol.

Benzeneazo-*p*-phenoxyacetic acid.

4-Benzeneazo-1-phenyl-3-benzylpyrazolone.

Benzeneazophenylcarbamic acid.

Benzeneazophenylglycine and -*p*-sulphonic acid.

Benzeneazophenylmethylglycine and -*p*-carboxylic and -*p*-sulphonic acids.

Benzene-5-azo-2:4-tetramethyldiaminotoluene.

Benzeneazotoluenes.

Benzene-5-azo-2:4-tolylene-diamine.

Benzeneazo-*p*-tolylxyacetic acid.

Benzenediazoamino-1-chloronaphthalene.

Benzenediazoaminotetrahydro- $\beta$ -naphthalene.

Benzenediazoaminotoluenes.

Benzene-*ant*idiao-hydrate.

Benzenediazo-iodide.

Benzenediazo-*p*-nitrophenylsulphone.

Benzenediazonium salts.

Benzene-*ant*idiazotate.

Benzenedisazofilicic acid.

Benzenedisazo-1:3:5-trihydroxyphenyl-*n*-butanone.

Benzophenone-*p*-*ant*idiao-compounds.

*p*-Benzoyl-amino- and -chloroaminoazobenzene.

Benzylazotate, potassium.

Bisazoxyacetic acid.

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Carbanilophenylazoacetaldoxime.

4-Carboxybenzeneazo-1:3-diphenylpyrazolone.

4-Carboxybenzeneazo-3-phenyl-5-*iso*-oxazolone.

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Carboxyphenylazobenzoylactic acid.  
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 Diazoaminotetrahydro- $\beta$ -naphthalene.  
 Diazoaminotoluenes.  
 $\alpha$ -Diazoanthraquinone.  
 1-Diazoanthraquinone-2-sulphonic anhydride.  
 Diazobenzene.  
 Diazobenzene chloride.  
 Diazobenzene-*p*-sulphonic acid.  
 Diazo-2,6-*di*bromoanisole.  
 Diazo-chlorides.  
 Diazo-compounds.  
 Diazogallic acid.  
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 Diazoisonitrosomethyluracil.  
 Diazonium salts.  
 Diazothiosulphonates.  
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 3:3'-Dimethylazobenzene.  
 Dimethylketazine.  
 Dimethyl-*p*-phenylenediamine, diazo-chloride of.  
 Diphenyl-*p*-azophenylene.  
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 1:5-Diphenyl-3-methylpyrazole-4-azobenzene.  
 4-Ethoxyazobenzene.  
*p*-cycloHexylbenzenediazonium sulphate.  
*p*-Hydroxyazobenzene.  
 Hydroxyazonaphthalene-5:5'-disulphonic acid.  
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 Methylazobenzene.  
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 Naphthaleneazobenzenesulphone.  
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 Phenylazoacetaldoxime.  
 Phenylazoacetoacetic acid.  
 Phenylazoacetylacetone.  
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 Phenylazoalkylalldoximes.  
 Phenylazoaminocrotonic acid.  
 Phenylazobenzoyl-*p*-nitrobenzoylactic acid.  
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 Phenylazo-1:2-diketopentamethylene.  
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 Phenylazoethylidenenitronic acid.  
 Phenylazomethylaminocrotonic acid.  
 Phenylazo-*m*-nitrobenzoylactic acid.  
 $\alpha$ -Phenylazo- $\delta$ -nitrophenylpentane- $\delta$ -ol- $\beta$ -onecarboxylic acid.  
 $\alpha$ -Phenylazo- $\delta$ -*p*-nitrophenylpentane- $\beta$ -one- $\alpha\delta$ -olide.  
 Phenylazoxyacetaldoxime.  
 Phenyl-diazomethane.  
 $\alpha$ -Phenyl- $\beta$ -6-diazo-3-methoxycinnamic acid.  
*p*-Propionyl-amino- and -chloroaminoazobenzene.  
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 Tetra-azodiphenyl chlorides.  
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*ar*-Tetrahydronaphthaleneazo- $\beta$ -naphthol.  
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*p*-Toluene-5-azo-4:6-*di*amino-*m*-xylene.  
*p*-Toluene-3-azo-5-chloro-2:4-tolylene-diamine.  
*p*-Tolueneazo-*p*-nitrobenzene.  
*p*-Tolueneazo-*p*-phenoxyacetic acid.  
*p*-Toluenediazoaminotetrahydro- $\beta$ -naphthalene.  
 Tolueneantidiazotates.  
*m*-Tolueneantidiao-hydrate.  
*p*-Tolueneantidiao-compounds.  
*p*-Tolylamino-*m*-hydroxyphenyl- $\mu$ -cyanoazomethine-*p*-nitrobenzene.  
*p*-Tolylamino- $\alpha$ -naphthyl-4-cyanoazomethine-*p*-nitrophenyl.  
*p*-Tolylazoacetaldoxime.  
*o*-Tolylazobenzoylactic acid.

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*o*-Triazobenzaldoxime.

*o*-Triazobenzamide.

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Apiose.

Araban.

Arabinoses.

Arahitol.

Cellobiose (*cellose*).

Cellulose.

Dextrins.

Dextrose.

Erythritol.

$\beta$ -Ethylgalactoside.

Fructose.

$\delta$ -Galactan.

Galactose.

Galactosidodextrose.

Galactosidogalactose.

Gelose.

Gentiobiose.

$\alpha$ -Glucophptose.

Glucose.

Glucosidegalactose.

Glucosone.

Glycogen.

Granulose.

Hemicelluloses.

Honey dextrin.

$\beta$ -Hydroxymethylerythrose (*apiose*).

Ketoses.

Lactose.

*iso*Lactose.

Levulose.

Maltose.

Mannan.

Manneotetrose.

Manninotriose.

Mannitol.

Mannose.

Melibiose.

Methylpentosan.

Methyltetrose.

Methyltriose.

Oxycelluloses.

Pentaerythritol.

Pentanetriolone.

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Pentosans.  
 Pentoses.  
 Potato-starch (*granulose*).  
 Raffinose.  
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 Erepsin.  
 Hydrogenases.  
 Invertase.  
 Jacquemase.  
 Kinases.  
 Lipase.  
 Maltase.  
 Oxydases.  
 Papain.  
 Papayotin.  
 Pectinase.  
 Pepsin.  
 Peptase.  
 Philothion.  
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Anæthole.  
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Anthragallol dimethyl ether.  
Anthrànols, ethers of.  
Anthrarin ethyl ethers.  
Anthronedimethylacetal.  
*iso*Apiole.  
Benzeneazobromo- $\alpha$ -naphthol ethyl ether.  
6-Benzoyl-1:2:4- and -1:4:2-xyleneol methyl ethers.  
Benzylidene- $\beta$ -dinaphthyl oxide.  
Butenylphenetole.  
4-*iso*Butoxy-1- $\alpha$ -hydroxypropylbenzene.  
Butyracetal.  
Butyrylphenetole.  
Cresols, methyl ethers of.  
Crotonacetal.  
 $\psi$ -Cumenol ethyl ether.  
Dianisylphenylmethane.  
Diehrysarobin methyl ether.  
1:3-Diethoxybenzene.  
Diethoxydimethyl ether.  
2:4'-Dihydroxydiphenylmethane dimethyl and diethyl ethers.  
Dihydroxymethoxymethylbenzene.  
2:3-Dihydroxynaphthalene methyl and ethyl ethers.  
Dihydroxyphenoxide.  
1:3-Dimethoxybenzene.  
2:4-Dimethoxydimethyl-5-bromo-methyl-1-phenol.  
2:7-Dimethoxynaphthalene.  
Dimethoxyphenoxide.  
Dimethylaminodimethylacetal.  
4:4'-Dimethyldiphenylene oxide.  
2:2'-Diphenol dimethyl and ethylene ethers.  
Dithymolylamine ethyl ethers.  
4-Ethoxy-1-allylbenzene.  
Ethoxybenzene.  
Ethoxyisoegenol.  
4-Ethoxy-1- $\alpha$ -hydroxybutylbenzene.

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4-Ethoxy-1- $\alpha$ -hydroxypropylbenzene.  
2-Ethoxymethyl-4-propenylcatechol ether.  
6-Ethoxy-3-methylpyridazine.  
6-Ethoxy-3-phenyl-5-methylpyridazine.  
*p*-Ethoxytriphenylcarbinyl ethylether.  
*p*-Ethoxytriphenylmethane.  
Ethylcatechol diethyl ether.  
Ethyl ether.  
Ethylene glycol methyl and propyl ethers.  
Ethylene oxide.  
Ethylisoegenol.  
Ethyl propyl ether.  
Ethylpyrogallol triethyl ether.  
Eugenol methyl ether.  
Euxanthone methyl ethers.  
Excoecarin dimethyl ether.  
Gallacetophenone methyl ethers.  
Hexylene oxide.  
Homocatechol dimethyl ether.  
Homoveratròle.  
 $\beta$ -Hydroxybutyracetal.  
1-Hydroxyamphenone methyl and ethyl ethers.  
Hydroxy- $\psi$ -cumylene *m*-glycol, *tri*-bromo-, dimethyl ether.  
Hydroxydibenzylanthracene ethyl ether.  
 $\alpha$ -Hydroxydihydroisoegenol ethers.  
 $\alpha$ -Hydroxy-*p*-ethylphenol  $\alpha$ -methyl and -ethyl ethers.  
5-Hydroxy-5-phenyl-10-methyl-5:10-dihydroacridine, ethers of.  
*o*-Hydroxy-*p*-xylyl alcohol, methyl ether of.  
Hydroxy-*p*-xylylene bromohydrin, methyl ether of.  
Hystazarin dimethyl ether.  
Methoxides.  
Methoxybenzene.  
Methoxydihydroanthracene.  
 $\alpha$ -Methoxy-*p*-ethylphenol.  
4-Methoxy-1- $\alpha$ -hydroxypropylbenzene.  
6-Methoxy-3-methylpyridazine.  
*p*-Methoxy- $\omega$ -nitrostyrene.  
Methoxyphenanthrenes.  
6-Methoxy-3-phenyl-5-methylpyridazine.  
*p*-Methoxytriphenylcarbinol, ethers of.  
*p*-Methoxytriphenylmethane.  
Methyl difluoroethyl ether.  
Methyleneoxide diacetate.  
Methylisoegenol.  
Methylglyceraldehyde, acetal of.  
Methylphloroglucinol alkyl ethers.  
Myricetin pentamethyl and hexaethyl ethers.  
 $\alpha$ -Naphthol methyl and ethyl ethers.  
1- $\beta$ -Naphthoxyethylpiperidine.

**Ethers.** See:—

- Oxanthranlyl methyl ether.  
 2-Phenanthryl methyl and ethyl ethers.  
 Phenetole.  
 Phenyl ethers.  
 Phenyl dianisylmethane.  
 Phenyl tolyl ethers.  
 Phloroglucinol, ethers of.  
 Propionylanisole.  
*p*-Propionylisobutoxybenzene.  
 Propionylphenetole.  
 4-*iso*Propyldihydroresorcin ethyl ether.  
 Purpurogallin trimethyl ether.  
 Pyrogallol di- and tri-ethyl ethers.  
 Pyromeconyl ethyl ether.  
 Resorcinol methyl ether.  
 Safrole.  
*iso*Safrole.  
 Storesinol methyl ether.  
 Succintetraethylacetate.  
 Terpene ethers.  
 Tetramethyldiaminobenzhydrol, ethers of.  
 Tetramethyldiaminodiphenylmethyl oxide.  
 Thymyl ethyl ether.  
 Tolyl methyl ethers.  
 Tri-*p*-anisylechloromethane.  
 Trianisylmethane.  
 2:3:8-Trihydroxynaphthalene tri-methyl ether.  
 Triphenyl-*p*-anisylmethane.  
 Undecyl ether.  
 Veratrole.
- Ethoxide**, thallium, density, and refractive and dispersive powers of (KAHLBAUM, ROTH, and SIEDLER), A., ii, 260.
- 4-Ethoxy-1-allylbenzene.** See Anæthole.
- Ethoxyanilinophosphoric acid**, barium salt (CAVEN), T., 1371.
- Ethoxyanilinophosphoryl amide** and chloride (CAVEN), T., 1371; P., 1901, 26.
- 4-Ethoxyazoxybenzene**, 3:5-*di*bromo- (JACKSON and FISKE), A., i, 362.
- m*-**Ethoxybenzaldehyde** and its phenylhydrazone, *tetrachloro*- (BILTZ and KAMMANN), A., i, 162.
- Ethoxybenzene**, *di*bromoamino- (JACKSON and FISKE), A., i, 362.
- 2-Ethoxybenzonitrile** and 3:5-*dinitro*- (BLANKSMA), A., i, 281.
- p*-**Ethoxybenzyl cyanide** (WERNER), A., i, 627.
- 7-Ethoxy-2-benzylchromone** (HANNACH and V. KOSTANECKI), A., i, 304.
- 4-Ethoxy-4-isobutylquinolnitrolic acid**, 3:5-*dinitro*-, potassium salt (MEISENHEIMER), A., i, 797.

- 6-Ethoxychromone** and its 2-carboxylic acid (DAVID and V. KOSTANECKI), A., i, 690.
- 4-(or 5)-Ethoxydeoxybenzoin-2-carboxylic acid** and amide (ONNERTZ), A., i, 99.
- 4-(or 5)-Ethoxydeoxybenzoin-2'-carboxylic acid**, and its oxime, and the lactone of the oxime acid (ONNERTZ), A., i, 100.
- 4-(or 5)-Ethoxydibenzyl-2-carboxylic acid** (ONNERTZ), A., i, 100.
- 6-Ethoxy-1:3-diketo-2-phenylhydrindene** (ONNERTZ), A., i, 99.
- 4-Ethoxy-2:6-dimethylnicotinic acid** and its salts and hydrochloride (MICHAELIS and HANISH), A., i, 823.
- 2-Ethoxy-4:6-dimethylpyrimidine** and its compound with mercuric chloride, and 5-bromo-derivative (ANGERSTEIN), A., i, 123.
- 3-Ethoxy-1:5-diphenyl-1:2:4-triazole** (WHEELER and BEARDSLEY), A., i, 503.
- Ethoxyisoeugenol** (POMERANZ), A., i, 93.
- δ-Ethoxy-β-hexanone-ε-carboxylamide-γ-carboxylic acid**, ε-cyano-, and its ethyl ester (ERRERA), A., i, 117.
- Ethoxyhydrocotarnine** (FREUND and BAMBERG), A., i, 557.
- 4-Ethoxy-1-α-hydroxybutylbenzene** (KLAGES), A., i, 610.
- 4-Ethoxy-1-α-hydroxypropylbenzene** and its acetate and phenylurethane (KLAGES), A., i, 609.
- Ethoxyindone**, chloro- (GLAWE), A., i, 782.
- d*-**Ethoxyindophenazines**, α- and β- (BURACZEWSKI and MARCHLEWSKI), A., i, 121.
- 3-Ethoxy-5-keto-1-phenyl-2:5-dihydro-triazole** (ACREE), A., i, 242.
- 2-Ethoxymethyl-4-propenylcatechol ether.** See *Ethoxyisoeugenol*.
- 6-Ethoxy-3-methylpyridazine** (POPPEMBERG), A., i, 61.
- 3-Ethoxyphenanthraquinone** (WERNER), A., i, 627.
- 3-Ethoxyphenanthrene-10-carboxylic acid** (WERNER), A., i, 628.
- p*-**Ethoxyphenylacetic acid** and its amide (WERNER), A., i, 627.
- α-p*-**Ethoxyphenyl-*o*-amino**- and -*o*-nitro-cinnamic acids (WERNER), A., i, 627.
- 6-(or 7)-Ethoxy-3-phenyl-1-benzylphthalazone** (ONNERTZ), A., i, 99.
- 6-(or 7)-Ethoxy-3-phenylisocarbostyryl** (ONNERTZ), A., i, 100.
- 6-(or 7)-Ethoxy-3-phenylisocoumarin**, and its dihydride, and the 4-bromo-derivative of the dihydride (ONNERTZ), A., i, 100.

- 6-Ethoxy-3-phenyl-5-methylpyridazine** and its salts (OPPENHEIM), A., i, 187.
- 6-(or 7-)Ethoxy-3-phenylisoquinoline, 1-chloro-** (ONNERTZ), A., i, 100.
- p*-**Ethoxyphenylsuccinamic acid** and its alkyl substituted derivatives (GILBODY and SPRANKLING), T., 789; P., 1900, 224.
- p*-**Ethoxyphenylsuccinimide**. See Pyranthin.
- p*-**Ethoxyphenyl-thiocarbamide** and -cyanamide and its polymeride (HELLER and BAUER), A., i, 445.
- β*-**Ethoxyphthalylacetic acid** (ONNERTZ), A., i, 99.
- 3-Ethoxyquinaldine** (KÖENIGS and STOCKHAUSEN), A., i, 693.
- 4-(or 5-)Ethoxystilbene-2-carboxylic acid** (ONNERTZ), A., i, 99.
- p*-**Ethoxysuccinanic acid**. See *p*-Ethoxyphenylsuccinamic acid.
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- Ethoxy-*p*-toluidinophosphoric acid**, barium salt (CAVEN), T., 1372.
- Ethoxy-*p*-toluidinophosphoryl amide** and chloride (CAVEN), T., 1372; P., 1902, 26.
- p*-**Ethoxytriphenylcarbiny ethyl ether** and dibromo- (BISTRZYCKI and HERBST), A., i, 777.
- p*-**Ethoxytriphenylmethane** and dibromo- (BISTRZYCKI and HERBST), A., i, 777.
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- Ethylcarboxyaconitic acid** (*pentenotetra-carboxylic acid*), ethyl ester (RUEMANN), T., 1214; P., 1902, 181.



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- $\beta$ -Ethylgalactoside** (FISCHER and ARMSTRONG), A., i, 746.
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- $\alpha$ -Ethylidenediglutacetic acid**, ethyl ester (HENRICH), A., i, 422.
- $\alpha$ -Ethylideneglutaric acid** (*pentenedicarboxylic acid*), physical constants of (FICHTER and MÜHLHAUSER), A., i, 204.
- i*-Ethylidenelactic acid**. See Lactic acid.
- p*-Ethylidenequinone**, tetra-, penta-, and hexa-bromo- (ZINCKE, SIEBERT, and REINBACH), A., i, 608.
- Ethyl-*s*-iodonitrophenyliodonium salts**, dichloro- (WILLGERODT and ERNST), A., i, 118.
- $\alpha$ -Ethylluteolin** and its tetra-acetyl derivative (V. KOSTANECKI and RÓŻYCKI), A., i, 105.
- Ethylmalonamic acid**, ethyl ester (FISCHER and DILTHEY), A., i, 270.
- Ethylmercaptohydrocotarnine** and its methiolide (FREUND and BAMBERG), A., i, 557.
- 14-Ethyl- $\beta_1\beta_2\alpha'_1\beta'_1$ -naphthacridone** (STROHBACH), A., i, 183.
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- Ethylolhomonicotinic acid**, lactone of, and its salts (KOENIGS), A., i, 180.
- o*-Ethylphenol** (STOERMER and KAHLEIT), A., i, 457.  
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- $\psi$ -*p*-Ethylphenol**, bromo-derivatives of (ZINCKE, SIEBERT, and REINBACH), A., i, 606; (ZINCKE and LEISSE), A., i, 615.
- 1-Ethylpiperidine**, chloro-, and its salts, and isomeride (MARCKWALD and FROBENIUS), A., i, 24.
- 3-Ethylpiperidyl-4-ethanol** and its aurichloride (KOENIGS), A., i, 395.
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- 2-Ethylpyridine**, condensation of, with formaldehyde (KOENIGS and HAPPE), A., i, 394.
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*α*-**Ethylthio-butyr**anilide, -glycollanilide, and -lactanilide (BECKURTS and FRERICHS), A., i, 764.

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**Hydrocarbons.** See also:—

Acetylene.

$\beta$ -Allylbenzene.

Allylmesitylene.

Amylbenzene.

Amylbenzenes.

Amylene.

Anthracene.

Aromadendrene.

Benzene.

Benzyl-5-fluorene.

Butane.

*iso*Butane.

Butenylmesitylene.

*p*-Butenyl-*m*-xylene.

Butylbenzenes.

*iso*Butylene.

Cadinene.

Calamene.

Camphane.

**Hydrocarbons.** See:—

Camphene.  
 Carvene.  
 Cetylbenzene.  
 Cetylmesitylene.  
 $\beta$ - $\psi$ -Cumyl- $\beta$ -butylene.  
 Cymene.  
 5:10-Dibenzylanthracene.  
 Dibenzylmesitylene.  
 Diisobutyl (*octane*).  
 Didehydrocampholene.  
 Dicyclohexyl.  
 $\Delta^{1:5}$ -Dihydromesitylene.  
 Dihydrophenanthrene.  
 $\Delta^{1:3}$ -Dihydrotoluene.  
 Dihydro-*m*-xylene.  
 $\beta\beta$ -Dimethylbutane.  
 Dimethyldicyclohexyl.  
 1:1-Dimethyl- $\Delta^{2:4}$ -dihydrobenzene.  
 1:3-Dimethyl-5-ethylbenzene.  
 1:5-Dimethyl-2-ethyl- $\Delta^1$ -tetrahydrobenzene.  
 1:1-Dimethylhexamethylene.  
 1:3-Dimethylcyclohexane.  
 Dimethyl- $\gamma\delta$ -hexane (*octane*).  
 Dimethylindenes.  
 Dimethylnaphthalene.  
 3:4-Dimethylcycloocta- $\Delta^{1:5}$ -diene.  
 1:3-Dimethylcyclopentane.  
 Dimethylisopropylbenzene.  
 Dimyrcene.  
 Dipentene.  
 Diphenyl.  
 Diphenylethanes.  
*s*-Diphenylethylene.  
 Diphenylcyclohexanes.  
 Diphenylmethane.  
 3:4-Diphenylcycloocta- $\Delta^{1:5}$ -diene.  
 Diphenylpropanes.  
 Diphenylpropylenes.  
 Ditolyl.  
 Docosane.  
 dicycloDodecatriene.  
 Durene.  
 Ethane.  
 Ethylbenzene.  
 Ethylene.  
 Ethylfluorene.  
*p*-Ethylstyrene.  
 Fenchene.  
 Fluorene.  
 cycloGeraniolene.  
 Heneicosane.  
 Heptadecane.  
 isoHeptylbenzene.  
 Hexacosane.  
 Hexadecane.  
 Hexadecenylmesitylene.  
 Hexadecenyl-*m*-xylene.  
 Hexamethylbenzene.  
 cycloHexane.  
 Hexanes.

**Hydrocarbons.** See:—

Hexaphenylethane.  
 $\beta$ -Hexene.  
 cycloHexylbenzene (*phenyleyclohexane*).  
 isoHexylene.  
 Homocarvomenthene.  
 Homomenthene.  
 Indene.  
 Laurolene.  
 isoLaurolene.  
 Limonenes.  
 Menthenes.  
 Mesitylene.  
 Methane.  
 Methenylbisfluorene.  
 Methoethenylbenzene ( $\beta$ -allylbenzene).  
*p*-Methylallylbenzene.  
 1-Methyl-3-*tert*.butylbenzene.  
 $\beta$ -Methyl- $\beta$ -butylene (*amylene*).  
 1-Methyl-3-ethylcyclohexene.  
 1-Methyl-3-ethylcyclopentane.  
 Methylfenchene.  
 Methylfluorene.  
 $\delta$ -Methyl- $\gamma$ -heptylene (*octylene*).  
 1-Methylcyclohexane.  
 1-Methylcyclohexene.  
 Methylindenes.  
 $\gamma$ -Methyl-2-methylenecyclopentane.  
 Methylcyclopentane.  
 $\beta$ -Methylpentane (*isohexane*).  
 1-Methylcyclo- $\Delta^2$ -pentene.  
 1-Methylpropyl-2-ethylethylene (*octylene*).  
*p*-Methylstyrene.  
 Methyltrimethylene.  
 Myrcene.  
 Naphthalene.  
 Naphthenes.  
 Nonadecane.  
 Nonylenes.  
 Octacosane.  
 Octadecane.  
 cycloOcta- $\Delta^{1:5}$ -diene.  
 Octanes.  
 Octinene.  
 Octylene.  
 Pentacosane.  
 Pentadecane.  
 Pentamethylbenzene.  
 Pentane.  
 isoPentane.  
 Pentinene.  
 Phellandrene.  
 Phenanthrene.  
 Phenylacetylene.  
 $\beta$ -Phenyl- $\beta$ -amylene.  
 Phenylbutadienes.  
 $\alpha$ -Phenyl- $\beta$ -butylene.  
 $\beta$ -Phenyl- $\beta$ -butylene.  
 Phenylidihydropinene.  
 $\beta$ -Phenyl- $\beta$ -isoheptylene.

**Hydrocarbons.** See:—

- Phenylcyclohexane.
- $\alpha$ -Phenyl- $\gamma$ -methyl- $\alpha\gamma$ -butadiene.
- $\alpha$ -Phenyl- $\gamma$ -methyl- $\alpha\gamma$ -pentadiene.
- Pinenes.
- Piperylene (*pentinene*).
- Polymyrene.
- cycloPropane.
- isoPropylbenzene.
- Propylene.
- Pulenene.
- Pyrodynopinalcolene.
- Salvene.
- Stilbene.
- Styrenes.
- Terpane.
- Terpenes.
- Terpinene.
- Tetracosane.
- Tetradecane.
- ar-Tetrahydro- $\beta$ -naphthalene.
- Tetrahydrotoluene.
- Toluene.
- Tricosane.
- Tridecane.
- Triethylbenzenes.
- Trimethyldicyclododecatriene.
- Trimethylene (cyclopropane).
- Trimethylethylene (*amylenes*).
- Triphenylmethane.
- Triphenylmethyl.
- Tropilidene.
- $\beta\gamma$ -Undecinene.
- Undecylene.
- Xylenes.
- Zingiberene.
- Hydrocarbostyryl-4-acetic acid.** See Dihydrocarbostyryl-4-acetic acid.
- iso**Hydrochelidonic acid.** See Pilomalic acid.
- Hydrochloric acid.** See under Chlorine.
- Hydrocinnamic acid.** See  $\beta$ -Phenylpropionic acid.
- Hydrocinnamyl-methyl- and -ethylamines and their salts** (ANDREE), A., i, 210.
- Hydrocotarninecarboxylamide methiodide** (FREUND and BAMBERG), A., i, 556.
- Hydrocotarnineethiocarbonamide methohydroxide and methiodide** (FREUND and BAMBERG), A., i, 557.
- Hydrocoumarone and its halogen derivatives and sulphonic chloride and amide** (BOES), A., i, 784.
- Hydrocyanic acid.** See under Cyanogen.
- Hydrofluoric acid.** See under Fluorine.
- Hydrogen in the atmosphere** (RAYLEIGH), A., ii, 391.
- preparation of pure (MELLOR and RUSSELL), T., 1279; P., 1902, 7.

- Hydrogen**, place of, in the periodic system (BRAUNER), A., ii, 66.
- stratifications of (CROOKES), A., ii, 374.
- discharge potential of, at a mercury cathode (COEHN and NEUMANN), A., ii, 118.
- determinations of inversion temperature of Kelvin effect for (OLSZEWSKI), A., ii, 444.
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- compressibility of, at low pressures (BATTELLI), A., ii, 244.
- diffusion of, through platinum (WINKELMANN), A., ii, 552.
- behaviour of, with chlorine (MELLOR and RUSSELL), T., 1279; P., 1902, 167.
- union of, with chlorine (MELLOR and ANDERSON), T., 414; P., 1902, 32; (MELLOR), T., 1280, 1292; P., 1902, 169, 176.
- under the influence of light (MELLOR and ANDERSON), T., 414; P., 1902, 32; (BEVAN), A., ii, 237.
- union of, with oxygen (BAKER), T., 400; P., 1902, 40.
- and oxygen, behaviour of, in presence of water (MARCACCI), A., ii, 392.
- action of, on selenides and sulphides (PÉLABON), A., ii, 253.
- relations of, to unsaturated elements and groups of elements (FEIST), A., i, 490; (VORLÄNDER), A., i, 562.
- effect of the presence of, on the spectrum of carbon (HERBERT), A., ii, 637.
- respiration of, by plants (POLLACCI), A., ii, 99.
- Hydrogen antimonide.** See Antimony hydride.
- arsenide. See Arsenic trihydride.
- bromide. See under Bromine.
- chloride. See under Chlorine.
- cyanide. See under Cyanogen.
- fluoride. See under Fluorine.
- iodide. See under Iodine.
- nitride. See Azonitride.
- Hydrogen peroxide**, crystallised (STAEDEL), A., ii, 604.
- pure solution of (JONES, BARNES, and HYDE), A., ii, 203.
- aqueous, lowering of the freezing point of (JONES, BARNES, and HYDE), A., ii, 203.
- intensifying action of, on oxidising agents (SCHAER), A., ii, 140, 603.
- decomposition of (KASTLE and CLARKE), A., ii, 314.
- decomposition of, by light (D'ARCY), A., ii, 297.



- Hydrogen peroxide**, catalytic decomposition of, by colloidal mercury and silver (McINTOSH), A., ii, 310.  
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 action of, on carbohydrates in presence of ferrous sulphate (MORRELL and CROFTS), T., 666; P., 1902, 55.  
 action of, on carbonates (KASANEZKY), A., ii, 317, 500.  
 action of, on cerium, thorium, and zirconium hydroxides (PISSARJEWSKY), A., ii, 565.  
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- Hydrogen peroxides**, higher, existence of (BACH), A., ii, 203.
- Hydrogen phosphide** (*phosphine*), preparation of gaseous (BODROUX), A., ii, 499.
- Hydrogen selenide**, physical properties of (DE FORCRAND and FONZES-DIACON), A., ii, 253.  
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- Hydrogen selenide**, vapour tension of, and the dissociation of its hydrate (DE FORCRAND and FONZES-DIACON), A., ii, 253.
- Hydrogen silicide**, liquid (MOISSAN and SMILES), A., ii, 318, 560.
- Hydrogen sulphide**, formation of, in alcoholic fermentation (SEIFERT), A., ii, 98; (POZZI-ESCOT), A., ii, 577.  
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 and hydrogen selenide, comparison of the properties of (DE FORCRAND and FONZES-DIACON), A., ii, 254.  
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- Hydrogen telluride**, physical properties and physiological action of (DE FORCRAND and FONZES-DIACON), A., ii, 498, 557.
- Hydrogen ions**, new method of determining the concentration of (JONES and RICHARDSON), T., 1140; P., 1902, 140.  
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- Hydrogen sulphide group**, new separation in the (KNOEVENAGEL and EBLER), A., ii, 697.
- Hydrogenases** (POZZI-ESCOT), A., i, 580.  
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- Hydrogöthite** (SAMOILOFF), A., ii, 88.
- Hydrolysis**. See Affinity.
- Hydroquinizarol triacetate** (PLEUS), A., i, 773.
- Hydroxamic acids**, formation of, from nitroparallins (BAMBERGER and RUST), A., i, 197.
- Hydroxamino oximinomalonic acid**. See Malondihydroxamic acid.
- p*-**Hydroxyacetophenone** and its oxime and semicarbazone (CHARON and ZAMANOS), A., i, 104.

- Hydroxy-acid**,  $C_{15}H_{20}O_4$ , from the action of alkalis and alkaline earths on  $C_{15}H_{18}O_8$  (BERTOLO), A., i, 815.
- Hydroxy-acids**, compounds of, with antimony pentachloride and tungsten chlorides (ROSENHEIM and LOEWENSTAMM), A., i, 358.  
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- Hydroxyaldehydes**, aromatic, synthesis of (DIMROTH and ZOEPPRITZ), A., i, 293.
- m*-**Hydroxy-*o*-isoamylbenzoic acid** and its ethyl ester (BAUER and EINHORN), A., i, 225.
- 5-Hydroxy-2-anilidonaphthalene-7-sulphonic acid** (BADISCHE ANILIN- & SODA-FABRIK), A., i, 92.
- Hydroxyanthraquinones**, preparation of, from the corresponding nitro-derivatives (FARBENFABRIKEN VORM. F. BAYER & Co.), A., i, 383.
- Hydroxyanthraquinones**, amino- and bromo-derivatives of (FARBENFABRIKEN VORM. F. BAYER & Co.), A., i, 382.
- 4-Hydroxyanthraquinone-2-sulphonic acid**, 1-amino-, and its salts (WACKER), A., i, 298.
- 1-Hydroxyanthraquinone-2-sulphonic acid**, 4-nitro-, introduction of amino-radicles into (FARBENFABRIKEN VORM. F. BAYER & Co.), A., i, 476.
- p*-**Hydroxyazobenzene**, action of chloro-acetic acid on (MAI and SCHWABACHER), A., i, 126.
- Hydroxyazonaphthalene-5:5'-disulphonic acid** and its ammonium salts (WACKER), A., i, 506.
- o*-**Hydroxyazoxybenzene** and its isomeride (BAMBERGER), A., i, 505.
- p*-**Hydroxyazoxybenzene**, synthesis of (BAMBERGER), A., i, 506.
- m*-**Hydroxybenzaldehyde**, tetrachloro-, and its acetyl derivative (BILTZ and KAMMANN), A., i, 162.
- p*-**Hydroxybenzaldehydeaniline** and its salts (DIMROTH and ZOEPPRITZ), A., i, 293.
- 3-Hydroxybenzaldehydephenylhydrazone**, tetrachloro-, and its acetyl derivative (BILTZ and KAMMANN), A., i, 162.  
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- p*-**Hydroxybenzaldehydephenylhydrazone** and its haloids and 3-nitro-derivative, oxidation of (BILTZ and AMME), A., i, 468.
- m*-**Hydroxy-benzaldoxime**, -benzamide, and -benzonitrile, tetrachloro-, and the acetyl derivative of the nitrile (BILTZ and KAMMANN), A., i, 162.
- 4-Hydroxy-5-benzeneazo-2:6-diphenylpyrimidine** (BÜLOW and HAILER), A., i, 326.
- 2-Hydroxy-1-benzeneazo-3-naphthoic acid** (STROHBACH), A., i, 162.
- "**3-Hydroxybenzeneazoxindone**" and its acetate, and compound with 3-aminobenzeneazoxindone (DIEPOLDER), A., i, 830.
- o*-**Hydroxybenzoic acid**. See Salicylic acid.
- 3-Hydroxybenzoic acid**, 4:6-dibromo- and 2-bromo-4:6-dinitro- (ROBERTSON), T., 1484; P., 1902, 190.  
2:6-dichloro- and 2:6- and 6:2-chloro-bromo- and their ethyl esters (MARTINI), A., i, 150.
- 4-Hydroxybenzoic acid**, 3-mono- and 3:5-di-bromo-, acetyl derivatives, and ethyl ester of the dibromo-compound (ROBERTSON), T., 1482; P., 1902, 190.
- Hydroxybenzoic acids**, halogenated, relation of their affinities to their constitution (COPPADORO), A., i, 783.  
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- Hydroxybenzophenone**, derivatives of (ULLMANN and GOLDBERG), A., i, 792.
- p*-**Hydroxybenzyl alcohol**, tri- and tetra-bromo-, and methyl ethers, and their acetyl derivatives (ZINCKE and WIEDERHOLD), A., i, 284.  
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- p*-**Hydroxybenzyl bromide**, tri- and tetra-bromo- (ZINCKE and WIEDERHOLD), A., i, 284.  
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- Hydroxybenzyl thiocyanates**, bromo-derivatives, and their acetyl compounds (STEPHANI), A., i, 148.
- 7-Hydroxy-2-benzylchromone**, and its acetate (HANNACH and v. KOSTANECKI), A., i, 304.
- m*-**Hydroxybenzylidene chloride** and its acetyl derivative, tetrachloro- (BILTZ and KAMMANN), A., i, 163.
- o*-**Hydroxybenzylideneacetoacetic acid** (WIDMAN), A., i, 374.
- α*-**Hydroxybenzylidenacetophenone** and its methyl and ethyl ethers (POND YORK, and MOORE), A., i, 105.

- Hydroxybenzylidene-2-bromoindanones**, and their acetyl derivatives (MINIAT), A., i, 296.
- o*-Hydroxybenzylidene-hydrazine and phenylsemithiocarbazide** (CURTIUS and FRANZEN), A., i, 831.
- 1- $\alpha$ -Hydroxybenzyl-4-methylcyclohexanol-2**, and its diacetate (TÉTRY), A., i, 470.
- 4- $\alpha$ -Hydroxybutyl-1:3-dimethylbenzene**, and its chloride (KLAGES), A., i, 612.
- 2- $\alpha$ -Hydroxybutyl-1:3:5-trimethylbenzene** and its acetate and phenylurethane (KLAGES), A., i, 613.
- $\beta$ -Hydroxybutyral** (WOHL and FRANK), A., i, 532.
- $\alpha$ -Hydroxybutyric acid**, and its ethyl ester, phenylurethanes of, and the lactam of the acid (LAMBLING), A., i, 603.
- $\beta$ -Hydroxybutyric acid**, resolution of, into its optically active components (MCKENZIE), T., 1402; P., 1901, 213; 1902, 185.
- $\beta$ -Hydroxybutyrolactone** (FICHTER and SONNEBORN), A., i, 256.
- 1-Hydroxycamphene** and its conversion into the  $\beta$ -halogen derivatives of camphor, and its methyl and ethyl ethers (FORSTER), T., 264; P., 1902, 25.
- $\beta$ -Hydroxycamphoric acid**. See  $\beta$ -Camphoric acid.
- iso*-Hydroxycarbamide** and its hydrochloride and diacetyl derivative (FRANCESCOINI and PARROZZANI), A., i, 139.
- 4-Hydroxyisocarbostyryl** and its phthaloylic acid, phthalide, and benzylidene derivative (GABRIEL and COLMAN), A., i, 642.
- Hydroxycarboxylic acids**, aromatic, formation of, in indifferent solvents, by Kolbe's reaction, and its relation to the cryoscopic behaviour of phenols in benzene and in other hydroxyl-free solvents (ONDO and MAMELI), A., i, 33.
- 6-Hydroxychromone** and its acetate (DAVID and v. KOSTANECKI), A., i, 690.
- Hydroxycinchotone** and its salts (SCHMID), A., i, 53; (WIDMAR), A., i, 173.
- p*-Hydroxycinnamic acid**, action of bromine on, and its methyl ester (ZINCKE and LEISSE), A., i, 615.
- Hydroxycomenic acid** (TICKLE and COLLIE), T., 1006; P., 1902, 170.
- o*-Hydroxy- $\psi$ -cumyl alcohol**, dibromo-, methyl ether and acetate (ANSELMINO), A., i, 286.
- o*-Hydroxy- $\psi$ -cumyl bromide** and iodide, dibromo- (ANSELMINO), A., i, 286.
- p*-Hydroxy- $\psi$ -cumyl alcohol**, dibromo-, formate and amyl ether of (STEPHANI), A., i, 148.
- Hydroxy- $\psi$ -cumyl**. See also  $\psi$ -Cumenol.
- Hydroxy- $\psi$ -cumyl bromide**, dibromo- (AUWERS and ANSELMINO), A., i, 214.
- chloride and iodide, dibromo-, and their acetyl derivatives (ANSELMINO), A., i, 216.
- p*-Hydroxycumylacetic acid**, dibromo- (STEPHANI), A., i, 148.
- Hydroxy- $\psi$ -cumylanilines**, *o*-, *m*-, and *p*-, and the dibromo-derivative and its acetyl compounds of the *m*-compound, and the acetyl derivatives of the *o*-compound (AUWERS and ANSELMINO), A., i, 214.
- Hydroxy- $\psi$ -cumylene dibromide**, dibromo- (AUWERS and ANSELMINO), A., i, 215.
- m*-glycol, dibromo-, bromide of (ANSELMINO), A., i, 216.
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- p*-Hydroxy- $\psi$ -cumylmalonic acid**, dibromo-, and its ethyl ester (STEPHANI), A., i, 148.
- Hydroxy- $\psi$ -cumylpyridine hydrobromide**, dibromo- (ANSELMINO), A., i, 215.
- Hydroxydehydroisophotosantonin acid** and its barium salt and acetyl derivative (FRANCESCOINI and VENDETTI), A., i, 546.
- Hydroxydibenzylanthracene**, and its ethyl ether (LIPPMANN and POLLAK), A., i, 754.
- $\beta$ -Hydroxy- $\alpha\alpha$ -diethylglutaric acid** and its *s*-ethyl ester and barium salt (REFORMATSKY), A., i, 588.
- 4-Hydroxydiethyl-*o*-toluidine** and its hydrochloride and benzoate (MÖHLAU, KLIMMER, and KAHL), A., i, 839.
- Hydroxydihydrocycloamine bases**, history and theory of (DECKER), A., i, 691.
- $\alpha$ -Hydroxydihydroisoeugenol**,  $\beta$ -mono- and  $\beta$ -*m*-di-bromo-, and their ethers and acyl derivatives (AUWERS and MÜLLER), A., i, 212.
- 4-Hydroxydihydrofencholenic acid** and its amide, lactone, and nitrile (MAHLA), A., i, 107.
- Hydroxydihydrotetramethylhæmatoxylo-**one, nitro-, and its reactions (PERKIN), T., 1063.
- Hydroxydihydrotrimethylbrazilone**, nitro-, and its acetate (PERKIN), T., 1020; P., 1902, 147; (GILBODY and PERKIN), T., 1048; (BOLLINA, v. KOSTANECKI, and TAMBOR), A., i, 482.

- $\alpha$ -Hydroxy- $\alpha\alpha$ -dimethylacetylacetone** and its dioxime and disemicarbazone (HARRIES), A., i, 345.
- Hydroxydimethylaminoacetyl dimethylamide** (WILLSTÄTTER), A., i, 350.
- 7-Hydroxy-2- $p$ -dimethylanilinonaphthalene** (GNEHM, BOTS, and WEBER), A., i, 831.
- $\alpha_1$ -Hydroxy- $\alpha\alpha$ -dimethylglutaric acid**, lactone of, and its silver salt (PERKIN), T., 259.
- $\beta$ -Hydroxy- $\alpha\alpha$ -dimethylglutaric acid**, synthesis of (PERKIN and SMITH), P., 1902, 214.
- 5-Hydroxydimethyl- $\alpha$ -naphthylamine** and 6-nitroso- (FUSSGANGER), A., i, 279.
- $\gamma$ -Hydroxy- $\beta\beta$ -dimethylpropionaldazine** (KÖNIG), A., i, 701.
- 4-Hydroxy-3:5-dimethylpyrazole** (SACHS and RÖHMER), A., i, 837.
- 6-Hydroxy-2:4-dimethylpyridine**. See  $\psi$ -Lutidostyrl.
- 6-Hydroxy-2:5-dimethylpyridine** and its 6-bromo-derivative and -3-carboxylic acid and its ethyl ester (ERRERA), A., i, 117.
- Hydroxydimethylpyrone** and its acetate (TICKLE and COLLIE), T., 1005; P., 1902, 170.
- 4-Hydroxydimethyl- $o$ -toluidine** and its hydrochloride, acetate, benzoate, and 5-nitroso- and its salts (MÖHLAU, KLIMMER, and KAHL), A., i, 838.
- Hydroxydiphenylamine**, dinitro- $m$ -thiocyano-derivatives (BADISCHE ANILIN- & SODA-FABRIK), A., i, 93.
- Hydroxydiphenylaminesulphonic acids**, dinitro- $m$ -thiocyano- (BADISCHE ANILIN- & SODA-FABRIK), A., i, 93.
- 3-Hydroxy-1:3-diphenyl-1:2:4-triazole** (WHEELER and BEARDSLEY), A., i, 502.
- 1-Hydroxyerythroanthraquinone**, 2:4-dibromo- (FARBENFABRIKEN VORM. F. BAYER & Co.), A., i, 477.
- 2-Hydroxy-5-ethoxybenzoylpyruvic acid**, ethyl ester (DAVID and v. KOSTANECKI), A., i, 690.
- $\alpha$ -Hydroxy-4-(or 5)-ethoxydibenzyl-2-carboxylic acid** (ONNERTZ), A., i, 99.
- $m$ -Hydroxy- $o$ -ethylbenzoic acid**, and its esters and acetyl and benzoyl derivatives (BAUER and EINHORN), A., i, 225.
- Hydroxyethyl dimethylacetio acid**, lactone of. See  $\alpha\alpha$ -Dimethylbutyrolactone.
- 4- $\alpha$ -Hydroxyethyl-1-mono- and -1:3-dimethylbenzenes**, and their phenylurethanes and chlorides (KLAGES), A., i, 611.
- 4- $\alpha$ -Hydroxyethyl-1-ethylbenzene** and its phenylurethane and chloride (KLAGES), A., i, 612.
- Hydroxyethylnitrocarbamide** (FRANCHIMONT and LUBLIN), A., i, 427.
- $\alpha$ -Hydroxy- $p$ -ethylphenol**, bromo-derivatives of, and their acetyl compounds (ZINCKE, SIEBERT, and REINBACH), A., i, 607.
- bromo-derivatives of, and their diacetates and  $\alpha$ -methyl and -ethyl ethers (ZINCKE and LEISSE), A., i, 615.
- Hydroxyethyl- $p$ -tolylpyridine**. See  $p$ -Tolyl-2-picolyllalkine.
- Hydroxyflavonole derivatives**, synthesis of (v. KOSTANECKI and TAMBOUR), A., i, 470.
- Hydroxyglutaric acid**, formation of, from casein (HABERMANN and EHRENFELD), A., i, 653.
- $\alpha$ -Hydroxyglutaric acid** (PAOLINI), A., i, 658.
- 4- $\alpha$ -Hydroxyhexadecyl-1:3-dimethylbenzene** (KLAGES), A., i, 613.
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- 3-Keto-1:1-dimethyl- $\Delta^4$ -tetrahydrobenzene**, bromo-derivatives and 5-chloro- (CROSSLEY and LE SUEUR), P., 1902, 238.
- $\gamma$ -Keto- $\alpha\delta$ -diphenyliminopentane- $\alpha$ -carboxylic acid**, ethyl ester, reactions of (SIMON), A., i, 422.
- Keto-3:5-diphenyl- $\Delta^2$ -tetrahydrobenzene-6-carboxylic acid**, ethyl ester (KNOEVENAGEL and SPEYER), A., i, 227.
- Ketohexyltetronic acid**, benzoyl derivative, and  $\psi$ -oxime of (WOLFF, GABLER, and HEYL), A., i, 676.
- 4-Keto-1-mono- and -1:3-di-methyl-1-dichloromethyldihydrobenzene** (AUWERS and WINTERNITZ), A., i, 218.
- 2-Ketomethylhexamethylenecarboxylic acid** and its ethyl ester (EINHORN and KLAGES), A., i, 74.
- $\alpha$ -Keto- $\beta$ -methylhexolactone- $\gamma$ -carboxylic acid** (FICHTER and PREISWERK), A., i, 443.
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- Ketone**,  $C_9H_{12}O_2$ , from 1:8:9-trihydroxyterpane (WALLACH and RAHN), A., i, 804.
- $C_9H_{16}O$ , and its semicarbazone, from  $\alpha$ -methyl- $\delta$ -isopropyladipic anhydride (MARTINE), A., i, 630.
- $C_{10}H_{10}O_4NCl$ , obtained in the preparation of 6:6'-dichloroindigotin (BADISCHE ANILIN- & SODA-FABRIK), A., i, 458.
- $C_{13}H_{10}O_3N_2$ , and its salts, oxime and phenylhydrazone, from the oxidation of *p*-nitrophenyl-2-picolyalkine (KNICK), A., i, 394.
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- unsaturated dicarboxylic acids from ethyl succinates and (STOBBE), A., i, 459; (STOBBE and NIEDENZU), A., i, 460; (STOBBE, STRIGEL, and MEYER), A., i, 461.
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- Acetonylacetone.
- Acetonylnaphthalimidine.
- Acetophenone.
- o*-Acetoxylindanone.
- Acetylacetone.
- Acetylaminacetophenones.
- Acetyl-1:1-dimethylcyclohexanones-3.
- Acetylionone.
- Acetylmesitylene.
- Acetylmethylheptanone.
- Acetylmethylheptenone.
- 2-Acetyl-3-methylquinoxaline.
- 4-Acetyl-2-phenyl-5-methylfurfuran.
- 4-Acetyl-2-phenyl-5-methylpyrrole.
- 2-Acetyl-3-phenylquinoxaline.
- p*-Acetyltetrahydrotoluene.



**Ketones and Quinones.** See :—

Acridone.  
 Aldehydotrichloroquinodichloride.  
 Alizarin.  
 Alkylacetylacetones.  
*iso* Amylacetone.  
 3- Amylpyrazolone.  
 Anhydrobisdiketohydrindene.  
 Anhydrobispyrindanedione.  
 Anhydrotetramethylhæmatoxylone.  
 Anhydrotrimethylbrazilone.  
 Anilino-1:2-diketopentamethylene-2-anil hydrochloride.  
 8-Anilino-1-nitroanthraquinone.  
 5-Anisidino-2-*isopropyl*benzoquinone.  
 Anisylidenecetone.  
 Anisylidenecamphor.  
 3-Anisylpyridazine.  
 3-Anisylpyridazine.  
 Anthrachrysone.  
 Anthraquinone.  
 Anthrarufin.  
 Antipyrine.  
 $\alpha$ -Arylaminoanthraquinones.  
 Asarone.  
 Benzenesulphophenanthraquinones.  
 Benzil.  
 Benzoin.  
 Benzophenone.  
 Benzo-1:4-pyrone.  
 Benzoylacetylacetone.  
 Benzoylbutyrylmethane.  
 Benzoylcamphor.  
 Benzoyldiacetylene.  
 Benzoyl-2:4-diethoxyacetophenone.  
 Benzoyl-5-fluorenone.  
 $\alpha\alpha$ -Benzoyl-iodo- and -nitro-camphor.  
 Benzoyloxyphenanthraquinones.  
 Benzoylphenylacetylene.  
 Benzoylpyridines.  
 $\omega$ -Benzylacetophenone.  
 Benzyl *iso*amyl ketone.  
 Benzylcamphor.  
 Benzyl cinnamenyl ketone.  
 Benzyl ethyl ketone.  
 $\gamma$ -Benzylethyl methyl ketone.  
 Benzylidenecetone.  
 Benzylidenecetophenone.  
 Benzylidene-*m*-aminoacetophenone.  
 Benzylidene-*p*-anisylidenecetone.  
 4-Benzylidenebis-3-phenyl-5-pyrazolone.  
 4-Benzylidene-1-*p*-bromophenyl-3-phenyl-5-pyrazolone.  
 Benzylidenecamphor.  
 Benzylidenedeoxybenzoins.  
 $\gamma$ -Benzylidene-ethyl methyl ketone.  
 Benzylidenementhones.  
 Benzylidene-*p*-methylacetophenone.  
 Benzylidenemethyl ethyl ketone.  
 Benzylidene- $\alpha$ -methylpentanone.  
 Benzylidenemethyl propyl ketone.

**Ketones and Quinones.** See :—

Benzylidenemethyl *isopropyl* ketone.  
 Benzylidenepropyl methyl ketone.  
 Benzylidenethujamenhone.  
 Benzylideneisothujone.  
 Benzyl *p*-methoxycinnamenyl ketone.  
 Benzyl methyleinnamenyl ketone.  
 Benzyl 3:4-methylenedioxcinnamenyl ketone.  
 $\alpha$ -Benzylmethyl ethyl ketone.  
 Benzylmethylcyclohexanone.  
 Benzyl methyl ketone.  
 Benzyl phenylethyl ketone.  
 Benzyl *n*-propyl ketone.  
 Benzyl stilbyl ketone.  
 Bisnaphtharonyl.  
*iso* Butylpyrazolone.  
 Butyrylmesitylene.  
 3-*iso* Butyryl-1-methylcyclopentanone-4.  
 Butyrylphenylacetylene.  
 Camphidones.  
 Camphor.  
*iso* Camphor.  
 Camphorophorone.  
 Camphorquinone.  
 Chromone.  
 Chrysarobin.  
 Chrysazin.  
 Chrysoquinone.  
 2-Cinnamoyl-3-methylquinoxaline.  
 Cinnamylidenecetophenone.  
 Cotoin.  
 Coumarone.  
 $\psi$ -Cumyl methyl ketone.  
 Decane- $\zeta\theta$ -dione.  
 Deoxybenzoin.  
 Deoxytrimethylbrazilone.  
 Diacetyl.  
 4:6-Diacetyl-5-phenyl-3-methylcyclohexane-3-ol-1-one.  
 Dianisylidenecetones.  
 Dibenzoyldianthranylmethane.  
 Dibenzoylethylenes.  
 Dibenzoylmesitylene.  
 Dibenzoyloxydiphenanthronylene.  
 2:5-Dibenzoyloxyquinone.  
 Dibenzylidenecetone.  
 Dibenzyl ketone.  
 Dibenzylmethylcyclohexanone.  
 Dibenzyl methyl ketone.  
 Diisobutyl ketone.  
 Di-*n*- and -*iso*-butyryl.  
 Dichrysarobin.  
 3:4-Diethoxybenzylidene-*m*-nitroacetophenone.  
 2:4-Diethoxy-3':5'-dimethoxybenzoylacetophenone.  
 Diethoxyhydrindene.  
 Diethyl diketone.  
 Digitollavone.  
 Dihydroisophorone.

**Ketones and Quinones.** See:—

Dihydropulegenone.  
 3:4-Dihydroxybenzylidene-*m*-nitroacetophenone.  
 5:7-Dihydroxychromone.  
 Dihydroxymethylheptanone.  
 Dihydroxymethylcyclohexanone.  
 1:8-Dihydroxynaphthaketones.  
 2:4-Diketo-5- and -3:5-diphenyltetrahydrothiazole.  
*p*-Diketohexahydotetrazine.  
*o*-Diketomethylcyclohexane.  
 Diketones.  
 1:2-Diketopentamethylene.  
 3:5-Diketo-2-phenyltetrahydrothiazole.  
 5:7-Dimethoxychromone.  
 Dimethoxyhydrindone  
 Dimethoxymethylenedioxyacetophenone.  
 Dimethylaminoacetophenones.  
*p*-Dimethylaminobenzylidene-*m*-aminoacetophenone.  
*s*-Dimethyldiaminodi-*o*-tolyl ketone.  
 3:6-Dimethylaminothymoquinone.  
 Dimethylcoumarones.  
 Dimethyldihydroresorcin.  
 Dimethylionones.  
 3:3-Dimethylcyclopentanone.  
 1:3-Dimethylpyridazone.  
 Dimethylpyrone.  
 Dinaphthaxanthone.  
 Dioxypinene.  
 Diphenacyl.  
 Dipropionyl.  
*o*-Dipropoxydiphenyltetrahydropyrone.  
 2:5-Dipropoxyquinone.  
 3:5-Di-*o*-toluidino-1-*isopropylbenzoquinone*.  
 Diisovaleryl.  
 3:5-Dixylidino-1-*isopropylbenzoquinone*.  
 Di-*as-m*-xylyldiketopiperazine.  
*α*-*iso*Dypnopinalcolin.  
 7-Ethoxy-2-benzylchromone.  
 6-Ethoxy-1:3-diketo-2-phenylhydrindene.  
 Ethoxyindone.  
 3-Ethoxy-5-keto-1-phenyl-2:5-dihydrotriazole.  
 3-Ethoxyphenanthraquinone.  
 6-(or 7)-Ethoxy-3-phenyl-1-benzylphthalazone.  
 4-Ethyl-3-amylpyrazolone.  
*p*-Ethylidenequinone.  
*α*-Ethylluteolin.  
 14-Ethyl- $\beta_1\beta_2\alpha'_1\beta'_1$ -naphthacridine.  
 Ethyl propyl ketone.  
 4-Ethyl-3-propylpyrazolone.  
 Ethylsalicylideneamphor.  
 Euxanthone.

**Ketones and Quinones.** See:—

Fenchone.  
 Filicyl-*n*-butanone.  
 Fluorenonequinoline.  
 Hexahydroxyanthraquinone.  
 cycloHexanolones.  
 Hydrocoumarone.  
*p*-Hydroxyacetophenone.  
 Hydroxyanthraquinones.  
 Hydroxybenzophenone.  
 7-Hydroxy-2-benzylchromone.  
*α*-Hydroxybenzylideneacetophenone.  
 Hydroxybenzylidene-2-bromoindanones.  
 6-Hydroxychromone.  
 Hydroxydihydotetramethylhæmatoxylone.  
 Hydroxydihydrotrimethylbrazilone.  
*α*-Hydroxy-*αα*-dimethylacetonylacetone.  
 Hydroxydimethylpyrone.  
 1-Hydroxyerythroanthraquinone.  
 3-Hydroxy-5-keto-1-phenyl-2:5-dihydrotriazole.  
 3-Hydroxy-5-keto-1-phenyl-2- and -4-methyl-4:5-dihydrotriazoles.  
 5-Hydroxy-7-methoxychromone.  
 3-Hydroxy-5-methoxy-2-methylquinone.  
*iso*Hydroxymethylchrysin.  
*p*-Hydroxy-*p*-methylhexahydroacetophenone.  
 Hydroxyphenanthraquinones.  
*o*-Hydroxyphenyl ethyl ketone.  
 3-*p*-Hydroxyphenylpyridazone.  
*o*-Hydroxyphenyl *p*-tolyl ketone.  
 5-Hydroxyisopropylbenzoquinones.  
 Hydroxypyrazolone.  
 Hystazarin.  
 Ianthone.  
 Indone.  
 Ionones.  
 4-Ketodihydrotoluene.  
 3-Keto-1:1-dimethyl- $\Delta_4$ -tetrahydrobenzene.  
 4-Keto-1-mono- and -1:3-di-methyl-1-dichloromethyl-dihydrobenzene.  
 4-Keto-5-methyl- and -5-phenylthiazolidine.  
 3-Keto-1:2:2:5:5-pentamethylpyrrolidine.  
 2-Ketopentoxazolidine.  
 4-Keto-1-phenyl-3-methylpyrazolone.  
 3-Keto-2:2:5:5-tetramethylpyrrolidine.  
 5-Keto-1:2:4-trimethyl-2-dichloromethyl-dihydrobenzene.  
 Ketotrimethyldihydroisooxazole.  
 Luteolin.  
 $\gamma$ -Lutidone.  
 Menthone.  
 Mesityl methyl ketone.  
 Mesityl oxide.

**Ketones and Quinones.** See:—

Mesityl pentadeeyl ketone.  
 Methoxybenzophenones.  
 7-Methoxychromone.  
*p*-Methoxydibenzylideneacetone.  
 3'-Methoxy-4'-ethoxybenzoyl-2:4-diethoxyacetophenone.  
 3'-Methoxy-4'-ethoxybenzoyl-2:4:6-trimethoxyethylacetophenone.  
 2-Methoxyfluorenone.  
 Methoxyphenanthraquinones.  
*o*-Methoxyphenyl ethyl ketone.  
 5-Methoxy-1-*isopropylbenzoquinone*.  
 Methylacetylmethylheptenone.  
 10-Methylacridone.  
 Methyl *isobutenyl* ketone.  
 Methyl *tert.* butyl ketone.  
 Methyltrichloroquinodichloride.  
 Methyldeoxybenzoin.  
 Methylenebisacetylacetone.  
 4-Methylenebis-3-methyl-5-pyrazolone.  
 4-Methylenebis-3-phenyl-5-pyrazolone.  
 3-Methyl-5-ethyl- $\Delta^2$ -cyclohexenone.  
 Methyl ethyl ketone.  
 Methylethylphenacylthetine salts.  
 3-Methyl-4-ethylpyrazolone.  
 Methylethylpyridazone.  
 Methylheptenone.  
 Methylheptyl ketone.  
 $\beta$ -Methylhexanone.  
 Methylcyclohexanones.  
 Methylcyclohexanose.  
 Methylcyclohexenone.  
 Methyl hexyl ketone.  
 Methylhydrindone.  
 Methylionones.  
 Methyl  $\beta$ -methylhexyl ketone.  
 Methylnataloe-emodin.  
 $\beta$ -Methyl- $\beta$ -nonene- $\zeta\theta$ -dione.  
 Methyl nonyl ketone.  
 $\zeta$ -Methyl- $\alpha$ -octene- $\epsilon\eta$ -dione.  
 Methylpentanones.  
 $\beta$ -Methylcyclopentanone.  
 Methyl propyl ketone.  
 Methylpyridazinephthalone.  
 Methyl-pyridazinone and -pyridazone.  
 2-Methyl-6-pyridyl methyl ketone.  
 Methylsalicylideneamphor.  
*p*-Methyltetrahydroacetophenone.  
 $\alpha$ -Naphthachromone.  
 Naphthacridone.  
 Naphthalidodimethyl ketone.  
 Naphthazarins.  
 5- $\alpha$ -Naphthylamino-1-nitroanthraquinone.  
 Nataloe-emodin.  
 $\alpha$ -Octene- $\epsilon\eta$ -dione.  
 Oximinodipropyl ketone.  
 Oxymethylpyridone.  
 Parasarone.  
 cycloPentanone.

**Ketones and Quinones.** See:—

$\Delta^2$ -cycloPentene-1-one-2-ol.  
 $\omega$ -Phenacetyl-2:4-diethoxyacetophenone.  
 4-Phenacyl-3:5-dimethylisooxazole.  
 Phenacylnaphthalimidine.  
 4-Phenacyl-1-phenyl-3:5-dimethylpyrazole.  
 Phenanthraquinone.  
 3-Phenanthrolquinone.  
 Phenoquinone.  
 Phenylacetone.  
 Phenylacetylacetophenone.  
 Phenylacetyl-*o*-aminoacetophenone.  
 Phenylchloromethylenecamphor.  
 4-Phenylldihydro-2-picolone.  
 1-Phenyl-2:3-dimethyl-5-pyrazolone.  
 3-Phenyl-2:6-di-*p*-tolyltetrahydro-1:4-pyrone.  
 Phenyl ethyl ketone.  
 Phenyl formazyl ketone.  
 Phenylhydroxymethylenecamphor.  
 Phenyliminobenzophenone.  
 1-Phenyl-3-methylpyrazolone.  
 3-Phenyl-5-methyl-pyridazinone and -pyridazone.  
 Phenyl naphthalidomethyl ketone.  
 Phenyl *n*-propyl ketone.  
 3-Phenylquinolineazone.  
 Phenyl tetrahydronaphthyl ketone.  
 Phenyl *p*-xylyl ketone.  
 Phorone.  
*iso*Phorone.  
 Pinacolin.  
 Piperonylidene-*p*-methylacetophenone.  
 Propionylacetophenone.  
 Propionylbutyryl.  
 Propionylmesitylene.  
 Propiophenone.  
*n*-Propyl *iso*amyl ketone.  
 4-*iso*Propyldihydroresorcin.  
 3-Propyl-4-hexylpyrazolone.  
*iso*Propylideneacetone.  
 Pulegenone.  
 Pulegone.  
 Pulenone.  
 Purpurogallin.  
 Pyrazolones.  
 Pyridoyl-1-phenylpyrazolones.  
 1-Pyridyl butyl ketone.  
 Pyridyltrichlorohydroxyquinone.  
 Pyridyltrichlorotriketopentamethylene.  
 Pyridyl methyl, ethyl, and propyl ketones.  
 2-Pyridyl phenethyl ketone.  
 Pyrodympinacolin.  
 Pyrone.  
 Quinizarin.  
 Quinone.  
*o*-Quinone.  
 Quinone C<sub>10</sub>H<sub>6</sub>O<sub>4</sub>.

**Ketones and Quinones.** See:—

- Quinone  $C_{20}H_{16}O_7(?)$ .  
 Quinophthalone.  
 Resacetophenone.  
 Rufigallic acid.  
 Santonin.  
 Scutellarin.  
 Scutellarin.  
 Stilbyl methyl ketone.  
 Tetrahydronaphthyl methyl ketone.  
 Tetrahydro-*p*-tolyl methyl ketone.  
 3:3':4':5'-Tetrahydroxyflavone.  
 2:4:6:4'-Tetramethoxybenzoylacetophenone.  
 2:4:6:3'-Tetramethoxy-4'-ethoxybenzoylacetophenone.  
 3:3':4':5'-Tetramethoxyflavone.  
 Tetramethyl $\delta$ aminobenzophenone.  
 Tetramethylhæmatoxylone.  
 Thujamenthone.  
 Thujone.  
*iso*Thujone.  
 Thymoquinone.  
 Thymoquinonethymolimine.  
 7-*p*-Toluidino-1-nitroanthraquinone.  
 5-Toluidino-2-*isopropyl*benzoquinones.  
*p*-Tolyl butyl ketone.  
*o*-Tolyl ethyl ketone.  
*p*-Tolyl methyl ketone.  
*p*-Tolyl propyl ketone.  
 3-*p*-Tolylpyridazinone.  
 3-*p*-Tolylpyridazone.  
 Triacetoneamine.  
 3:3':4'-Trihydroxyflavone.  
 $\beta\gamma\delta$ -Triketopentane.  
 $\beta\gamma\delta$ -Triketo- $\delta$ -phenylbutane.  
 3':4':5'-Trimethoxy-2:4-diethoxybenzoylacetophenone.  
 2:4:6-Trimethoxydiphenyltriketone.  
 2:4:6-Trimethoxy-2'-ethoxybenzoylacetophenone.  
 3:3':5'-Trimethoxyflavone.  
 Trimethylbrazilones.  
 Trimethyldehydrobrazilone.  
 Trimethylcyclohexanones.  
 Trimethylcyclohexenone.  
 2:4:4-Trimethylcyclo- $\Delta^2$ -hexenone.  
 4:5:5-Trimethylcyclopentanone.  
 3:3:4-Trimethyl-2-quinolone.  
 Tropinone.  
*iso*Valerylacetone.  
 Vinylacetoneamine.  
*m*-Xyldinomethyleneacetylacetone.  
*m*-Xylyl pentadecyl ketone.

**Ketonic acid**,  $C_9H_{16}O_3$  and its semicarbazone from the oxidation of pulegone (WALLACH and COLMANN), A., i, 724.

$C_9H_{16}O_3$  and its lactone, oxime, and semicarbazone, from the oxidation of *isothujone* (WALLACH), A., i, 801.

**$\beta$ -Ketonic acids**, esters, synthesis of (MOUREU and DELANGE), A., i, 164.

optically active (LAPWORTH and HANN), T., 1491, 1499; P., 1902, 144, 145.

action of organomagnesium compounds on (GRIGNARD), A., i, 420.

$\alpha$ -derivatives of (LOCQUIN), A., i, 704.

$\alpha$ -substituted, action of nitrous acid on (BOUVEAULT and LOCQUIN), A., i, 704.

**Ketonic alcohols**, action of nitric acid on (PONZIO), A., i, 134.

**3-Keto-1:2:2:5:5-pentamethylpyrrolidine** and its additive salts and oxime (PAULY), A., i, 560.

**2-Ketopentoxazolidine**, 1-nitro- (FRANCHIMONT and LUBLIN), A., i, 427.

**1-Keto-5-phenyl-3-cinnameryl- $\Delta^2$ -tetrahydrobenzene-6-carboxylic acid**, ethyl ester (KNOEVENAGEL and SPEYER), A., i, 227.

**4-Keto-1-phenyl-3-methylpyrazolone**, and its hydrate, oxime, and phenylhydrazine (SACHS and BARSCHALL), A., i, 504.

**$\epsilon$ -Keto- $\beta$ -isopropylheptoic acid** and its semicarbazone (WALLACH and FRESenius), A., i, 801.

**$\delta$ -Keto- $\beta$ -isopropylhexoic acid** and its oxime and semicarbazide (CROSSLEY), T., 676; P., 1901, 172; 1902, 86.

**Ketoses**, isolation of (NEUBERG), A., i, 264, 660.

**Ketotariric acid** and its oxime (ARNAUD), A., i, 343.

**3-Keto-2:2:5:5-tetramethylpyrrolidine** and its additive salts (PAULY), A., i, 560.

**5-Keto-1:2:4-trimethyl-2-dichloromethyldihydrobenzene** and 3:6-dibromo- (AUWERS and WINTERNITZ), A., i, 218.

**Ketotrimethyldihydroisooxazole** and its oxime (HARRIES), A., i, 184.

**Ketoximes**, formation of (FRANCESCONI and MILESI), A., i, 660.

**Kidney**, extracts of, physiological action of (GÉRARD), A., ii, 575.  
 diseased, the work of secretion in (SOETBEER), A., ii, 417.

**Kilbrickenite**, identity of, with geocronite (PRIOR), A., ii, 404.

**Kinases** of microbic origin (DELEZENNE), A., ii, 615.

**Kissi powder**. See *Piper Fumchonii* under Agricultural Chemistry.

**Koenenite** from Volpriehausen, Hanover (KINNE), A., ii, 611.



**Kohlrabi.** See Agricultural Chemistry.  
**Kola nut** and its fluid extracts, estimation of alkaloids in (WARIN), A., ii, 483.  
**Kosidin**,  $\alpha$ - and  $\beta$ -Kosin, and **Kosotoxins** from Koso flowers (BOEHM and LOBECK), A., i, 167.  
**Krypton**, atomic weight and classification of (WILDE), A., ii, 393.  
**Ktypeite**, identity of, with conchite (VATER), A., ii, 89.

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**Laboratory hood**, new construction of (HABERMANN and OESTERREICHER), A., ii, 201.  
**Labradorite** from Minnesota (WINCHELL), A., ii, 462.  
**Lactams**, formation of, from lactim ethers (WISLICENUS and KÖRBER), A., i, 533.  
**Lactanilide**,  $\alpha$ -thio- (BECKURTS and FRERICHs), A., i, 764.  
**Lactic acid** (*i-ethylidenelactic acid*; *α-hydroxypropionic acid*), formation of, from pentoses (KATSUYAMA), A., i, 257.  
 influence of acidic oxides on the specific rotation of (HENDERSON and PRENTICE), T., 658; P., 1902, 88.  
 phenylurethane of, and its salts and lactam (LAMBING), A., i, 537.  
 in the blood of geese (KOWALEWSKI and SALASKIN), A., ii, 619.  
 detection and estimation of, in gastric juice (VOURNASOs), A., ii, 364.  
 estimation of, in wine (MÖSLINGER), A., ii, 180.  
**Lactic acid**, antimony sodium salt (MORITZ and SCHNEIDER), A., i, 703.  
 mercury salts (GUERBET), A., i, 703.  
 potassium salt, influence of acidic oxides on the specific rotation of (HENDERSON and PRENTICE), T., 658; P., 1902, 88.  
**Lactic fermentation.** See Fermentation.  
**Lactim ethers**, conversion of, into lactams (WISLICENUS and KÖRBER), A., i, 533.  
*Lactobacillus delbrücki* and *L. fermentum* (BEYERINCK), A., ii, 97.  
**Lactone**,  $C_8H_{14}O_2$  from the compound  $C_9H_{15}O_2$  (PETSCHNIKOFF), A., i, 338.  
 $C_9H_{14}O_2$  from the acid  $C_9H_{16}O_3$  (WALLACH), A., i, 802.  
 $C_{10}H_{16}O_2$ , obtained in the preparation of pulegic acid (BOUVEAULT and TÉTRY), A., i, 420.  
 $C_{13}H_{16}O_2$  from the acid  $C_{13}H_{18}O_3$  (MICHEL and SPITZAUER), A., i, 292.

**Lactone**,  $C_{14}H_{17}O_5N$ , from the base  $C_{14}H_{15}O_4N_2$  (FREUND and BAMBERG), A., i, 556.  
 $C_{14}H_{20}O_2$ , from the oil of *Asarum canadense* (POWER and LEES), T., 71; P., 1901, 210.  
 $C_{14}H_{20}O_3$ , from the condensation of ethyl iodoacetate and citraldehyde in presence of zinc (TÉTRY), A., i, 535.  
 $C_{17}H_{14}O_3$  and  $C_{17}H_{16}O_3$ , from the reduction of  $\alpha$ -oxy- $\gamma$ -phenyl- $\beta$ -benzylidenebutylolactone and  $\alpha$ -oxy- $\beta$ -phenyl- $\gamma$ -benzylbutylolactone (ERLENMEYER), A., i, 543.  
 $C_{17}H_{16}O_3$  (four), from the reduction of the lactones  $C_{17}H_{14}O_3$  (ERLENMEYER), A., i, 544.  
 **$\gamma$ -Lactones**, unsaturated (THIELE), A., i, 152.  
**Lactones.** See also :—  
 $\gamma$ -Acetoxy- $\beta$ - $\gamma$ -diphenyl- $\Delta\alpha$ -crotonolactone and  $\alpha$ -benzylidenebutylolactone.  
 $\gamma$ -Acetoxy- $\alpha$ -phenyl- $\gamma$ -benzylbutylolactone.  
 Acetylcoumarin.  
 Angelic acid, lactones of.  
 $\alpha$ -Anisylidene- $\Delta\beta$ -angelicalactone.  
 Artemisin.  
 Azlactones.  
 $\beta$ -Benzhydrylpicolinolactone.  
 Benzoximinoketolactone.  
 Butenolactone.  
 $\alpha$ -isoButyl- $\beta$ -isopropylbutylolactone.  
 Camphenololactone.  
 Carboxydimethoxymandelic acid, lactone of.  
 Citraptén.  
 Crotonylolhomonicotinic acid, lactone of.  
 Decolic acid, lactone of.  
 Dehydrocamphenololactone.  
 Desylacetic acid, lactones of.  
 4:6-Diacetyltribromocoumarin.  
 Dibutylolactone.  
 Dihydrobrazilic acid, lactone of.  
 Dihydrobrazilinic acid, and dinitro-, lactones of.  
 Dihydrocornicularic acid, lactones of.  
 Dihydrohematoxylinic acid, lactone of.  
 Dihydrolanolactone.  
 Dihydroxyamphenololactone.  
 $\alpha\beta$ -Dihydroxy- $\alpha$ -phenyl- $\gamma$ -benzylbutylolactone.  
 Dihydroxyvderolactone.  
 4:6-Dimethoxy- $\alpha$ -methylecoumarin.  
 $\alpha\alpha$ -Dimethylbutylolactone.  
 $\beta\gamma$ -Dimethylbutylolactoneacetic acid, lactone of.

**Lactones.** See:—

- $\gamma\epsilon$ -Dimethyl- $\gamma$ -(or  $\delta$ )-hydroxyhydro-sorbolactone.  
 $\beta\gamma$ -Diphenylbutyrolactone.  
 $\beta\gamma$ -Diphenyl- $\Delta^{\alpha}$ -crotonolactone.  
 $\gamma\delta$ -Diphenylvalerolactone.  
 Ethylolhomocitric acid, lactone of.  
 Galactonolactone.  
 $\beta$ -Hydroxybutyrolactone.  
 $\alpha$ -Hydroxy- $\alpha\alpha$ -dimethylglutaric acid, lactone of.  
 Hydroxyethylmethylacetic acid, lactone of.  
 $p$ -Hydroxyhexahydrotoluic acid, lactone of.  
 $\gamma$ -Hydroxy- $\alpha$ -ketobutane- $\alpha\gamma$ -dicarboxylic acid,  $\alpha\gamma$ -lactone of.  
 Hydroxyvinylcoumarin.  
*m*-Meconine.  
 $\gamma$ -Methoxy- $\beta\gamma$ -diphenyl- $\Delta^{\alpha}$ -crotonolactone.  
 Methyltetronic acid, lactone of.  
 $\alpha$ -Oxy- $\beta$ -phenyl- $\gamma$ -benzylbutyrolactone.  
 $\alpha$ -Oxy- $\gamma$ -phenyl- $\beta$ -benzylidenebutylolactone.  
 $\alpha$ -Phenyl- $\gamma$ -benzyl- $\Delta^{\alpha}$ -crotonolactone.  
 Phenyl- $\Delta^{\alpha}$ -crotonolactone.  
 3-Phenyl-1-hydrindone-2-acetolactone.  
 Thujamenthoneketolactone.  
*iso*Thujoneketolactone.  
 Trimethylmalic acid,  $\beta$ -lactone of.  
 4-Trimethylmethylpyridine-3-carboxylic acid, lactone of.  
 2-Trimethylmethylquinoline-3-carboxylic acid, lactone of.  
 $\delta$ -Valerolactone.  
**Lactic acid**,  $C_3H_5O_3$ , from thujamenthoneketolactone (WALLACH), A., i, 803.  
**Lactose** (*milk sugar*), magnetic rotation of (PERKIN), T., 190; P., 1901, 256.  
   quantitative decomposition of, by *Bacillus acidi lactici* (HAACKE), A., ii, 343.  
   derivatives of (DITMAR), A., i, 532.  
   estimation of, in milk (PATEIN), A., ii, 536.  
   estimation of, polarimetrically, in milk (PEYTOUREAU), A., ii, 361.  
*iso*Lactose and its osazone (FISCHER and ARMSTRONG), A., i, 746.  
**Lacto-serum** (FULD), A., i, 845.  
   coagulation of casein by (MÜLLER), A., i, 409.  
**Lævulose** (*d-fructose*), in human body-juices (NEUBERG and STRAUSS), A., ii, 676.  
   magnetic rotation of (PERKIN), T., 189; P., 1901, 256.

- Lævulose** (*d-fructose*),  $\beta$ -naphthylhydrazones of, isomeric (ALBERDA VAN EKENSTEIN and DE BRUYN), A., i, 747.  
   phenylmethyllosazone, phenylbenzyllosazone, and diphenyllosazone of (NEUBERG), A., i, 264.  
**Lamps** for spectra (BECKMANN), A., ii, 373.  
**Langbeinite**, formation of (VAN'T HOFF, MEYERHOFFER, and COTTELL), A., i, 321.  
**Lanthanum**, atomic weight of (BRAUNER and PAVLIČEK), T., 1243; P., 1901, 63; (JONES), A., ii, 563.  
   containing didymium and praseodymium, influence of cerium on (MARC), A., ii, 503.  
**Lanthanum sulphate**, new hydrate of (BRAUNER and PAVLIČEK), T., 1262.  
**Lard**, Bulgarian (PETKOW), A., ii, 115.  
**Latent heats.** See Thermochemistry.  
**Laudanine** and its ethers (HESSE), A., i, 307.  
**Lauric acid** and its amide, chloride, anilide, toluidide, and salts (CASPARI), A., i, 419.  
**Lauroleone**, constitution of (ZELINSKY and LEPESCHKIN), A., i, 143.  
*iso*Lauroleone, constitution of, and its hydrobromide and hydriodide (ZELINSKY and LEPESCHKIN), A., i, 143.  
**Laurolic acid** and its isomeride (BREDT, HOUBEN, and LEVY), A., i, 374.  
**Lead**, radioactive (GIESEL), A., ii, 78, 208; (HOFMANN and STRAUSS), A., ii, 78; (HOFMANN and WÖLFEL), A., ii, 261, 397.  
   electrolytic preparation of (LINN), A., ii, 475.  
   pseudo-solution of (GUTHRIE), A., ii, 610.  
   action of water on (RŮŽIČKA), A., ii, 77.  
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**Lead alloys** with antimony, copper, iron, and tin, analysis of (PONTIO), A., ii, 478.  
   with lithium (LEBEAU), A., ii, 256.  
   with tellurium (FAY and GILLSON), A., ii, 260.  
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   chloride, decomposition-tension of molten (SACHER), A., ii, 121.  
   hydroxide, solubility of (HERZ), A., ii, 77.  
   nitrate, spectrum of (HARTLEY), T., 570; P., 1902, 68.  
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- Triplumbic tetroxide** (*red lead*), volumetric evaluation of (SZTERKHERS), A., ii, 531.
- Lead sulpharsenite.** See Baumhauerite.
- pentathionate, use of, for toning solutions (A. and L. LUMIÈRE and SEYEWITZ), A., ii, 606.
- Lead organic compounds:—**  
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- Lead,** separation of, from antimony, copper, and tin (RÜSSING), A., ii, 230.
- Lead chamber process.** See Sulphuric acid under Sulphur.
- Leather,** estimation of free sulphuric acid in (PAESSLER and SLUYTER), A., ii, 223.
- Leaves.** See Agricultural Chemistry.
- Lecithin** from brain (Koch), A., ii, 676.  
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- Lecithins** (BERNARD), A., ii, 415.
- Lecture experiments,** new (BODROUX), A., ii, 391.
- Lees,** estimation of total tartaric acid in (HUBERT), A., ii, 481.
- Leguminosæ.** See Agricultural Chemistry.
- Leiphamum** (ZOFF), A., i, 465.
- Lemon juices,** commercial, composition of (SENDTNER), A., ii, 181.  
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- Lenzinite** from Ventura Co., California (MERRILL), A., ii, 462.
- Leonite** from Leopoldshall (STRANDMARK), A., ii, 666.
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- Lepidoptera,** digestive enzymes of some (SAWAMURA), A., ii, 673.
- Leucæmia,** lymphatic, metabolism in (HENDERSON and EDWARDS), A., ii, 277.
- Leucauramine G** (GNEUM and WRIGHT), A., i, 295.

- Leucauramines,** new reactions of (MÖHLAU, HEINZE, and ZIMMERMANN), A., i, 244.  
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- o-Leucauraminobenzoic acid** and its sodium salt (MÖHLAU and HEINZE), A., i, 244.
- Leucine** as nutrient for plants (SCHULZE), A., ii, 165, 280.  
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- Leucocytes,** physiology of (STASSANO and BILLON), A., ii, 678.  
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- Leucocytosis** following intravenous injections of sodium cinnamate (SHAW), A., ii, 277.
- Leucyl-leucine** (FISCHER), A., i, 351.
- Lichens** and their constituents (HESSE), A., i, 680; (ZOFF), A., i, 465, 788.  
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- Light-filters,** simple trough for (WINTHER), A., ii, 437.
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- Limestones,** crystalline, of Ceylon (COOMARA-SWAMY), A., ii, 567.
- Limetatin,** constitution of, and its *mono-* and *di-chloro-*derivatives (TILDEN and BURROWS), T., 508; P., 1901, 216.
- Limonene** from oil of rue (POWER and LEES), T., 1590; P., 1902, 193.
- d*-**Limonene** (*carene*), magnetic rotation of (PERKIN), T., 292; P., 1902, 29.
- l*-**Limonene,** magnetic rotation of (PERKIN), T., 292; P., 1902, 29.
- d*-**Linalool** from the oil of *Asarum canadense* (POWER and LEES), T., 63; P., 1901, 210.
- Lindera Benzoin* seeds, fatty oil in the (CASPARI), A., i, 419.
- Linseed oil,** constituents of (FÖKIN), A., i, 740.  
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- Lipase** in blood (DOVON and MOREL; HANRIOT), A., ii, 571, 672.  
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- Lipase**, relation of, to fat metabolism (LOEVENHART), A., ii, 217.  
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- Lipolytic function** of the blood (DOYON and MOREL), A., ii, 411.
- Liquefaction** of gaseous mixtures (CAUBET), A., ii, 382; (KUENEN), A., ii, 491.
- Liqueur wines** and vintage musts, special characters and analysis of (CARI-MANTRAND), A., ii, 712.
- Liqueurs**, estimation of essential oils in (MANN), A., ii, 433.
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- Liquids**, physical purity of (DWELSHAUVERS-DERY), A., ii, 644.  
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- Lithium**, transport number for, in phenol (RIESENFELD), A., ii, 594, 595.  
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- Lithium alloys** with antimony, lead, and with tin (LEBEAU), A., ii, 256.
- Lithium antimonide** (LEBEAU), A., ii, 256.  
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- Lithium silicide** (MOISSAN), A., ii, 452.
- Lithium-ammonium**, decomposition of, by ammonium chloride (MOISSAN), A., ii, 72.  
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- Diamylthiolstilbene.
- Dibenzylthiolstilbene.
- Diethylthiolstilbene.
- Dimethylpyrimidine mercaptans.
- $\alpha\beta$ -Diphenyl- $\alpha\alpha$ -dibenzyl- and - $\alpha\alpha$ -diphenyl-thioethane- $\beta$ -al.
- $\beta\beta$ -Diphenylthiol- $\gamma$ -methylpentane- $\delta$ -one.
- Diphenylthiolstilbene.
- Diphenyl-1:2:4-triazole mercaptans.
- Ethylmercaptohydrocotarnine.
- Mercapto-butyltetrol- and -methylol-oxazolines.
- 5-Methylthioacridol.
- 4-Phenyl-5-aniltriazolone-3-thiol.
- $\alpha$ -Phenyl- $\gamma\gamma$ -diamylthiolbutane- $\alpha$ -al.
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- Adiponitrile (*butane,  $\alpha\alpha'$ -dicyano-*).
- $\alpha$ -Anilinopyrotartaric acid nitrile.
- $\beta$ -Anilinitricarballylic acid nitrile.

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- Benzonitrile.
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- Diacetonitrile.
- Diethylaminoacetonitrile.
- $\alpha$ -Diethylaminopropionitrile.
- Dihydrofencholenitrile.
- 2:4-Dihydroxybenzylidenemalononitrile.
- p*-Dimethylaminobenzylidenemalononitrile.
- 2-Ethoxybenzonitrile.
- p*-Ethoxybenzyl cyanide.
- Hippuronitrile.
- m*-Hydroxybenzonitrile.
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- $\beta$ -Methylcyclopentanemethylidene-carboxylonitrile.
- Phenanthraquinone cyanides.
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Carboxy-phenyl- and -tolyl-arsenic acids.

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*o*-Hydroxymercurisalicyclic acid.

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2-Acetyl-3-methylquinoxaline, oxime of.

4-Acetyl-2-phenyl-5-methylfurfuran, oxime of.

*p*-Acetyltetrahydrotoluene, oximes of.

Aldehydotrichloroquinodichloride, oxime of.

Anhydrobrazilic acid, oxime of.

Aromadendral, oxime of.

Benzaldoxime.

Benzoyl-5-fluorenoneoxime.

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Benzoylpyridines, oximes of.

Benzylideneacetone, oxime of.

Benzylideneacetophenone, oxime of.

Benzylidenecamphoroxime.

$\gamma$ -Benzylidene-ethyl methyl ketone, oxime of.

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Benzylidenemethyl ethyl ketone, oxime of.

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$\alpha$ -Benzylmethyl ethyl ketone, oxime of.

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Di-*n*- and -*iso*-butyryldioximes.

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*m*-Dimethylaminoacetophenone, oxime of.

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*iso*Hexaldehyde, oxime of.

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*p*-Hydroxyacetophenoneoxime.

*m*-Hydroxybenzaldoxime.

$\alpha$ -Hydroxy- $\alpha\alpha$ -dimethylacetonylacetone, dioxime of.

*o*-Hydroxylaminobenzaldoxime.

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 Tetrahydronaphthyl methyl ketone, oxime of.  
 Thujamenthoneketolactone, oxime of.  
 Thujone, oxime of.  
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*p*-Tolyldihydroacetaldoxime.  
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- $\gamma$ -Phenyl- $\alpha$ -benzoylacetacetic acid, ethyl ester (HAILER and BÜLOW), A., i, 327.
- $\alpha$ -Phenyl- $\gamma$ -benzyl- $\Delta^{\alpha}$ -crotonolactone (THIELE and STRAUS), A., i, 158.
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- $\alpha$ -Phenyl-*p*-chlorocinnamonitrile, and *p*-nitro- (V. WALTHER and RAETZE), A., i, 467.
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- Phenylcinnamic acid, esters (BAKUNIN), A., i, 370.
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- 1-Phenyl-4-dimethylhydrouracil (SLIMMER), A., i, 207.
- 5-Phenyl-3:5-dimethylphenónaphth-acridol, 2-amino-, and its acetyl derivative (ULLMANN, RACOVITZA, and ROZENBAND), A., i, 210.
- 1-Phenyl-3:5-dimethylpyrazole-4-acetic acid and its methyl ester and copper salt (MARCH), A., i, 706.
- 1-Phenyl-3:5-dimethylpyrazole-4- $\alpha$ - and - $\beta$ -propionic acids (MARCH), A., i, 706.
- 1-Phenyl-2:3-dimethyl-5-pyrazolone and its derivatives, compounds of, with methyl aminohydroxybenzoates (EINHORN), A., i, 497.
- 1-Phenyl-2:3-dimethylpyrazolone, 5-thio- (MICHAELIS), A., i, 120.
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- 1-Phenyl-2:5-dimethylpyrrole-3-carboxylic acid and its ethyl ester (FEIST), A., i, 489.
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- m*-Phenylenediamine, methylation of (MORGAN), T., 655; P., 1902, 87.
- m*-Phenylenediamine, 2:5-dichloro-, and its acyl derivatives, and the action of diazonium salts on (MORGAN and NORMAN), T., 1382; P., 1902, 185.
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- m*-Phenylenedicarbylamine, and *p*-Phenylenedicarbylamine and its tetrabromide (KAUFLER), A., i, 278.
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- 5-Phenyl-3-methylcyclohexane-3-ol-1-one-4:6-dicarboxylic acid, isomeric ethyl esters (RABE and ELZE), A., i, 710.
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- Phenylmethylnitroamine, 2:4:6- and 4:2:6-bromo-dinitro-, and 2:6:4- and 2:4:6-dibromonitro- (BLANKSMA), A., i, 600.
- $\alpha$ -Phenyl- $\gamma$ -methyl- $\alpha\gamma$ -pentadiene (KLAGES), A., i, 669.
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- s*-Phenylmethylsuccinic acid and its salts (RUHEMANN), T., 1216; P., 1902, 181.
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- 6-Phenyl-2-piperonylalkidine** and its salts (THORAU SCH), A., i, 234.
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Acid-albumin.  
Albumins.  
Albuminoid.  
Albumoses.

**Proteids**. See :—

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Atmid keratose.  
Atmid keratin.  
Casein.  
Caseinogen.  
Caseoses.  
Chitin.  
Chondro-albumoid.  
Coaguloses.  
Collagen.  
Cystein.  
Cystin.  
Egg-albumin.  
Elastin.  
Fibrin.  
Fibroin.  
Gelatin.  
Globulin.  
Gluko-proteids.  
Gluten.  
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Hæmins.  
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Ichthylepidin.  
Kephalin.  
Keratin.  
Lactoserum.  
Lecithin.  
Melanins.  
Mucin.  
Mucoids.  
Nucleo-histon.  
Nucleo-proteid.  
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Peptone.  
Plasteins.  
Protein.  
Proteoses.  
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 $\beta$ -Amylsulphoneisobutyl methyl ketone.  
 $\beta$ -Amylsulphone- $\beta$ -methyl- $\beta$  phenylethyl phenyl ketone.  
*o*-Anisylmethylsulphone.  
*o*-Anisylsulphoneacetic acid.

**Sulphones.** See:—

- o*-Anisylsulphone-ethyl alcohol.
- β*-Amylsulphone-*β*-phenylethyl phenyl ketone.
- Benzaldehyde-dialkyl- and -diaryl-sulphones.
- m*-Benzenedibenzylsulphone.
- m*-Benzenedisulphoneanilide.
- m*-Benzenedisulphonedibenzylanilide.
- m*-Benzenedisulphonehydroxylamine.
- m*-Benzenediiododimethyldisulphone.
- Benzophenone-di-benzyl- and -ethyl-sulphones.
- β*-Benzylsulphone-*β*-methyl-*β*-phenylethyl phenyl ketone.
- β*-Benzylsulphone-*β*-phenylethyl phenyl ketone.
- Bistetramethylenesulphone.
- ψ*-Cumylsulphoneacetic acid.
- ψ*-Cumylsulphone-ethyl alcohol.
- Di-*β*-alkylsulphoneisobutyl ketones.
- ββ*-Diamylsulphone-butane-*γ*-one, -*γ*-methylpentane-*δ*-one, and -pentane-*γ* and -*δ*-ones.
- ββ*-Diamylsulphonepentane-3-one.
- Di-*o*-anisylethylenedisulphone.
- Dibenzylacetonedialkylsulphones.
- ββ*-Dibenzylsulphone-*γ*-methylpentane-*δ*-one, and -pentane-*γ* and -*δ*-ones.
- Di-*ψ*-cumylethylenedisulphone.
- Di-*α*- and -*β*-naphthylethylenedisulphones.
- ζζ*-Diphenylsulphone-*β*-methylheptane-*γ*-one.
- Dipthaliminosulphonal.
- Disulphones.
- Di-*m*- and -*p*-xylylethylenedisulphones.
- 2-Methylcyclo-tetramethylene-1:3-disulphone.
- Naphthylsulphoneacetic acid.
- Naphthylsulphone-ethyl alcohols.
- α*-Phenyl-*γγ*-dibenzylsulphonebutane-*α*-al.
- Phenylethylenedisulphone.
- Phenylsulphoneacetic acid.
- Phenylsulphone-ethyl alcohol.
- β*-Phenylsulphone-*β*-methyl-*β*-phenylethyl phenyl ketone.
- β*-Phenylsulphone-*β*-phenylethyl methyl ketone.
- α*-Phenylsulphone-*β*-phenylethyl phenyl ketone.
- ββγγ*-Tetrabenzylsulphonebutane.
- ββεε*-Tetrabenzylsulphonehexane.
- γγζζ*-Tetrabenzylsulphone-*β*-methylheptane.
- ββεε*-Tetraphenylsulphonehexane.
- ββγ*-Trialkylsulphone-*δ*-phenylbutanes.
- ααγ*-Tribenzylsulphone-*αγ*-diphenylpropane.

**Sulphones.** See:—

- m*-Xylylalkylsulphones.
- o*-Xylylenedibenzylsulphone.
- cyclo-o*-Xylylene-1:3-disulphone-2-methylene, -2-methylmethylene, and -2-phenyl-2-methylmethylene.
- Xylylsulphoneacetic acids.
- Xylylsulphone-ethyl alcohols.
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6-nitro-, and its hydrobromide and hydrochloride, and methylation of (V. TATSCHALOFF) A., i, 443.

*m*-Toluidine, 5-nitro-, methylation of, and its hydrobromide (HAIBACH), A., i, 443.

*p*-Toluidine, 2-nitro-, methylation of, and its hydrobromide (HAIBACH), A., i, 444.

5-Toluidine, 2:4-*di*bromo-, and its acetyl derivative (DAVIS), T., 872; P., 1902, 118.

6-Toluidine, 2:4-*dinitro*- (COHEN and DAKIN), T., 28; P., 1901, 214.

Toluidines, coupling of, with diazo-compounds (MEHNER), A., i, 576.

*o*-Toluidinoacrylic acid, *o*-toluidide of (DAINS), A., i, 603.

*p*-Toluidinomethylenebenzyl cyanide (DAINS), A., i, 603.

Toluidinomethylenemalononic acids, *o*- and *p*-, and their ethyl esters, *o*- and *p*-toluidides of (DAINS), A., i, 603.

7-*p*-Toluidino-1-nitroanthraquinone (FARBENFABRIKEN VORM. F. BAYER & Co), A., i, 382.

*p*-Toluidino-phosphoryl chloride and -phosphamic acid (CAVEN), T., 1367; P., 1901, 27.

5-*m*-Toluidino-2-isopropylbenzoquinone, 3:6-*di*bromo- (BÖTERS), A., i, 473.

5-*p*-Toluidino-2-isopropylbenzoquinone, 3:6-*di*chloro- (BÖTERS), A., i, 474.

*p*-Toluidino-*p*-toluquinoneoxime, formation of (BÖRNSTEIN), A., i, 165.

*o*-Tolunaphthacridine (ULMANN), A., i, 119.

*p*-Toluoiltartaric acid, ethyl ester, nitration of (FRANKLAND, HEATHCOTE, and GREEN), P., 1902, 251.

Toluquinol, *pentabromo*- and its acetate (ZINCKE and WIEDERHOLD), A., i, 285.



(*Tolyl compounds Me = 1.*)

**Toluquinol**, tetrabromo- and tetrachloro-, and their diacetyl derivatives (RICHTER), A., i, 163.

tetrachlorobromo-, and its acetate (ZINCKE and WIEDERHOLD), A., i, 283.

*p*-**Tolquinophthalone** tetrabromide (EIBNER and MERKEL), A., i, 495.

*p*-**Toluthioquinanthrene** tetranitrate and disulphate and hydrochloride of the acetyl compound (EDINGER and EKELEY), A., i, 231.

**Tolyl methyl ethers**, *o*- and *p*-, condensation of, with benzaldehyde (FEUERSTEIN and LIPP), A., i, 769.

*p*-**Tolyl** thiocyanate and disulphide (RABAUT), A., i, 673.

*N*-*o*-**Tolylacetimino-ethyl ether** hydrochloride (LANDER), T., 597; P., 1902, 73.

*o*-**Tolylallophanic acid**, ethyl ester (PICKARD, ALLEN, BOWDLER, and CARTER), T., 1571.

*p*-**Tolylamino-*m*-hydroxybenzyl alcohol** (GNEHM and VEILLON), A., i, 288.

*p*-**Tolylamino-*m*-hydroxyphenyl- $\mu$ -cyanoazomethine-*p*-nitrobenzene** (GNEHM and VEILLON), A., i, 287.

*p*-**Tolylamino- $\alpha$ -naphthyl-4-cyanoazomethine-*p*-nitrophenyl** (GNEHM and RÜBEL), A., i, 145.

*m*-**Tolylarsenic compounds** (MICHAELIS and EISENLOHR), A., i, 415.

*p*-**Tolylarsenic compounds** (MICHAELIS, ULRICH, ZIEGLER, and EPPENSTEIN), A., i, 413.

*p*-**Tolylazoacetaldoxime**, constitution of (VOSWINCKEL), A., i, 844.

*o*-**Tolylazobenzoylacetic acid**, ethyl ester (BÜLOW and HALLER), A., i, 326.

*p*-**Tolylazocarbonamide** (BAMBERGER), A., i, 509.

*N*-*o*- and *p*-**Tolylbenzimidino-ethers** (LANDER), T., 595; P., 1902, 73.

*o*-**Tolylbiuret** (PICKARD, ALLEN, BOWDLER, and CARTER), T., 1571.

*p*-**Tolyl butyl ketone** and its semicarbazone (BLAISE), A., i, 164.

*m*-**Tolylecyanamide** and its benzoyl derivative (HELLER and BAUER), A., i, 445.

*p*-**Tolylecyanamide**, and its salts and benzoyl derivative (HELLER and BAUER), A., i, 445.

*p*-**Tolyldialkylarsines** and their salts (MICHAELIS and KLATT), A., i, 413.

**3-Tolyl-2:4-dibutyl- $\alpha$ -naphthaisooxazine** (BETTI), A., i, 57.

*p*-**Tolyldicarbylamine**, combination of, with toluidine, and with sulphur (SABANÉEFF, RAKOWSKY, and PROSIN), A., i, 604.

(*Tolyl compounds Me = 1.*)

**1-*o*-Tolyl-2:5-dimethylpyrrole-3:5-dicarboxylic acid** and *m*-amino- (BÜLOW and LIST), A., i, 312.

**1-*m*-Tolyl-2:5-dimethylpyrrole** and its 3:4-dicarboxylic acid (BÜLOW and LIST), A., i, 312.

**1-*p*-Tolyl-2:5-dimethylpyrrole-3:4-dicarboxylic acid**, amino-, and its acid salts (BÜLOW and LIST), A., i, 238.

*o*-**Tolylenebis-2:5-dimethylpyrrole-3:4-dicarboxylic acid** and its ethyl ester and acid silver salt (BÜLOW and LIST), A., i, 237.

*p*-**Tolylenebis-2:5-dimethylpyrrole-3:4-dicarboxylic acid** and its ethyl ester (BÜLOW and LIST), A., i, 312.

*m*-**Tolylenediamine**, methylation of (MORGAN), T., 653; P., 1902, 87.

**2:4-Tolylenediamine**, nitroso- (TÄUBER and WALDER), A., i, 118.

*p*-**Tolylenediamine**, difference of basicity of the amino-groups in (BÜLOW and LIST), A., i, 312.

*s*-**Tolylenediamine** and its diacetyl derivative (DAVIS), T., 873; P., 1902, 118.

**Tolylenediamines**, 2:4- and 3:5-, 5- and 2-chloro-, and their acyl derivatives (MORGAN), T., 95; P., 1901, 237.

*o*-**Tolyl ethyl ketone** and its semicarbazone (BLAISE), A., i, 164.

$\beta$ -*p*-**Tolylglutaranil**,  $\beta$ -*p*-**Tolylglutaranilic acid**, and  $\beta$ -*p*-**Tolylglutaric acid** and its salts and anhydride (AVERY and PARMELEE), A., i, 679.

*p*-**Tolylglyoxalosazone** and *p*-**Tolylglyoxal bisphenylmethylhydrazone** (KUNCKELL and VOSSEN), A., i, 645.

**Tolyl group**, migration of the, in *as*-phenyltolylethylene (TIFFENEAU), A., i, 666.

**3-*p*-Tolylhexahydropyridazine** and its salts (KATZENELLENBOGEN), A., i, 122.

*p*-**Tolylhydrazoacetaldoxime**, constitution of (VOSWINCKEL), A., i, 844.

**6-Tolylhydroxylamine**, 2:4-*o*-nitro- (COHEN and DARIN), T., 27; P., 1901, 214.

*o*-**Tolylhydroxyoxamide** and its salts and acetyl derivative (PICKARD, ALLEN, BOWDLER, and CARTER), T., 1571; P., 1902, 197.

*p*-**Tolyl-*m*-hydroxyphenazinesulphonic acid** and its salts (GNEHM and VEILLON), A., i, 288.

**5-Tolyl- $\psi$ -indophenazine**, and 9-bromo- (V. KORCZYNSKI and MARCHLEWSKI), A., i, 648.

*p*-**Tolyl methyl ketone**, hydrazone and semicarbazone of (SORGE), A., i, 380.

(*Tolyl compounds Me=1.*)

- p*-Tolyl- $\alpha$ -naphthylamine and its acyl, bromo-, nitro-, and nitroso-derivatives, and -sulphonic acid and its salts (GNEHM and RÜBEL), A., i, 145.
- m*-Tolylnitrosoamine, 2:4:6-*tribromo*- (HANTZSCH and POHL), A., i, 843.
- p*-Tolylnitrosoamine, *p*-*mono*- and 2:6-*di*-bromo- and *o*- and *p*-nitro- (HANTZSCH and POHL), A., i, 843.
- o*-Tolylloxamic acid, ethylester (PICKARD, ALLEN, BOWDLER, and CARTER), T., 1571.
- Tolylloxaminosulphonic acids, *m*-amino-, and its calcium salt and diazo-compound (SCHOELLKOPF, HARTFORD & HANNA Co.), A., i, 119.
- o*-Tolylphthalamic acid, nitroso-derivative of (KUHARA and FUKUI), A., i, 35.
- o*-Tolylphthalimides, *s*- and  $\alpha$ - (KUHARA and FUKUI), A., i, 35.
- p*-Tolyl-2-picolylalkine and its salts (DIERIG), A., i, 827.
- p*-Tolyl propyl ketone, and its semicarbazones (BLAISE), A., i, 164.
- Tolylpurpurates, *o*- and *p*-, potassium salts (BORSCHKE and LOCATELLI), A., i, 226.
- 3-*p*-Tolylpyridazine and its 6-chloro-, 6-iodo-, nitro-, amino-, 6-phenoxy, 6-methoxy, and 6-ethoxy derivatives, and their salts (KATZENELLENBOGEN), A., i, 121.
- 3-*p*-Tolyl-pyridazinone and -pyridazone, and 1-methyl and 1-ethyl derivatives of the pyridazone (KATZENELLENBOGEN), A., i, 121.
- p*-Tolylpyrrolidine and its pierate (KATZENELLENBOGEN), A., i, 122.
- p* Tolylsemicarbazide (BAMBERGER), A., i, 509.
- 4-*p*-Tolylsemithiocarbazide (BUSCH and ULMER), A., i, 575.
- Tolylthioglycollic acids, *o*- and *p*- (RABAUT), A., i, 673.
- Tolylthiohydantoic acids. *o*- and *p*- (WHEELER and JOHNSON), A., i, 760.
- Tolyl- $\psi$ -thiohydantoins, *o*- and *p*-, labile and stable, and their acetyl derivatives (WHEELER and JOHNSON), A., i, 759.
- o*-Tolyltrimethylammonium bromide, 4-nitro- (STADEN), A., i, 444.
- m*-Tolyltrimethylammonium bromide, 5-nitro- (HAIBACH), A., i, 444.
- p*-Tolyltrimethylammonium bromide, 2-nitro- (HAIBACH), A., i, 444.
- Toning solutions. See Photochemistry.
- Tourmaline mixtures, theory of (TSCHERMAK), A., ii, 91.
- Toxicity of organo-metallic compounds, influence of the methyl groups on the (LAFFONT), A., ii, 620.
- Toxins, action of sunlight on (EMMERLING), A., i, 195.
- action of erepsin and intestinal juice on (SIEBER and SCHUMOFF-SIMONOWSKI), A., ii, 680.
- nature and properties of mixtures of, with their antitoxins (DANYSZ), A., ii, 575.
- and antitoxins, action of, *in vitro* and *in corpore* (BASHFORD), A., ii, 277.
- Transparency of matter for X-rays, law of (BENOIST), A., ii, 191.
- Transport numbers. See Electrochemistry.
- Trees. See Agricultural Chemistry.
- Triacetoneamine, compounds of, with the alkali metals (MERCK), A., i, 86.
- Triacetyl-. See also under the Parent Substance.
- Triacetylraharinose, bromo- and chloro- (CHAVANNE), A., i, 346.
- Triacetyldibromodextrose (FISCHER and ARMSTRONG), A., i, 263.
- Triacetyl galactonic acid and its anilide (RUFF and FRANZ), A., i, 259.
- Triacetylmethylglucoside bromohydrin (FISCHER and ARMSTRONG), A., i, 263.
- $\beta\beta\gamma$ -Trialkyl- $\delta$ -phenylbutanes, *trithio*- (POSNER), A., i, 297.
- $\beta\beta\gamma$ -Trialkylsulphone- $\delta$ -phenylbutanes (POSNER), A., i, 297.
- Tri-*p*-anisylacetoneitrile (v. BAEYER and VILLIGER), A., i, 770.
- Trianisylcarbinol and its salts (v. BAEYER and VILLIGER), A., i, 381.
- Trianisylcarbinols (v. BAEYER and VILLIGER), A., i, 770.
- Tri-*p*-anisylchloromethane (v. BAEYER and VILLIGER), A., i, 771.
- Trianisylmethane (v. BAEYER and VILLIGER), A., i, 381.
- Triazan derivatives (BAMBERGER), A., i, 246, 321, 577; (BAMBERGER and GROB), A., i, 247; (BAMBERGER and FREI), A., i, 248, 324; (VOSWINKEL), A., i, 321.
- o*-Triazobenzaldoxime (BAMBERGER and DENUTH), A., i, 95.
- products from (BAMBERGER and DENUTH), A., i, 650.
- o*-Triazobenzamide (BAMBERGER and DENUTH), A., i, 651.
- Triazole, formula of (PELLIZZARI), A., i, 321.
- nitrate, preparation of (SILBERRAD), T., 602; P., 1902, 44.
- 1:2:3-Triazole, synthesis of derivatives of (DIMROTH), A., i, 403.

- 1:2:4-Triazole (*pyrro- $\alpha\beta'$ -diazole*) derivatives (WHEELER and BEARDSLEY), A., i, 502.
- Triazolens, so-called, constitution of (HANTZSCH), A., i, 325.
- Tribenzoyl-. See under the Parent Substance.
- Tribenzylamine, and its *m*-tricarboxylic acid, and *tri-m*-cyano-derivative (EHRlich), A., i, 25.
- Tribenzyltriaminotri-*p*-tolylarsine (MICHAELIS and KRAHE), A., i, 521.
- aa\gamma*-Tribenzylsulphone-*\alpha\gamma*-diphenylprop-ane (POSNER), A., i, 297.
- Tri-*tert*. butylphenylarsenic compounds (MICHAELIS and TRAEGL), A., i, 524.
- sec*-.Tricapryl alcohol. See *sec*-.Trioctyl alcohol.
- Tricarballic acid (*propane  $\alpha\beta\gamma$ -tricarboxylic acid*), synthesis and dissociation constant of, and its cyano-derivative, esters, and anhydro-acid (BONE and SPRANKLING), T., 29; P., 1901, 215.
- conductivity of esters of (WEGSCHEIDER), A., i, 618.
- Tricarboethoxymethyl bromide (WHEELER and JOHNSON), A., i, 761.
- Tricosane (MABERY), A., i, 734.
- Tri-*p*-cumylarsenic compounds (MICHAELIS and OBERG), A., i, 523.
- Tri-*\psi*-cumylarsenic compounds (MICHAELIS and v. KARCHOWSKI), A., i, 523.
- Tridecane and chloro-. (MABERY), A., i, 733.
- 1:2:3-Triethoxybenzene. See Pyrogallol triethylether.
- p*-Triethylarsenibenzobetaine and its salts (MICHAELIS and EPPENSTEIN), A., i, 414.
- Triethylbenzene, *s*- and *as*-, separation of (KLAGES), A., i, 432.
- Triethylbenzenesulphonic acids, *s*- and *as*-, and their salts, chlorides, amides, and anilides (KLAGES), A., i, 433.
- s*-Triethyliodobenzene (KLAGES), A., i, 433.
- Triethyl- $\beta$ -naphthylammonium iodide (REYCHLER), A., i, 757.
- Tri-*p*-ethylphenylarsenic compounds (MICHAELIS and SCHNEEMANN), A., i, 523.
- Triethylxanthine (BOEHRINGER & SÖHNE), A., i, 505.
- 1:2:3-Trihydroxybenzylideneaniline (DIMROTH and ZOEPFRITZ), A., i, 294.
- Trihydroxybutyric acid. See *d*-Erythronic acid.
- $\alpha\beta\gamma$ -Trihydroxy- $\alpha\delta$ -diphenylvaleric acid and its salts (THIELE and STRAUS), A., i, 158.
- 3:3':4'-Trihydroxyflavone and its triacetate (v. KOSTANECKI and RóŻYCKI), A., i, 105.
- 3:3':5'-Trihydroxyflavone and its triacetate (v. KOSTANECKI and WEINSTOCK), A., i, 817.
- 1:8:9-Trihydroxyhexahydrocymene (STEPHAN and HELLE), A., i, 631.
- Trihydroxymethylanthraquinone (m. p. 224.5°—225.5°). See *iso*-Hydroxymethylchrysin.
- 4:5:5'-Trihydroxy-4-methyldihydrouracil (BEHREND and GRÜNEWALD), A., i, 834.
- 2:3:8-Trihydroxynaphthalene and its triacetate, trimethyl ether, and -6-sulphonic acid (FRIEDLÄNDER and SILBERSTERN), A., i, 794.
- 1:8:9-Trihydroxyterpane (WALLACH and RAHN), A., i, 804.
- Trihydroxyterpineol (WALLACH and RAHN), A., i, 723.
- 2:2':2''-Trihydroxy-1:1':1''-trinaphthylmethane, *eso*-anhydride of, disruption of, by bromine (FOSSE), A., i, 449.
- $\beta\gamma\delta$ -Triketopentane, preparation of, and its diphenylhydrazone, and disemicarbazone (SACHS and RÖHMER), A., i, 837.
- $\beta\gamma\delta$ -Triketo- $\delta$ -phenylbutane and its hydrate,  $\beta$ -phenylhydrazone and  $\beta$ -semicarbazone (SACHS and RÖHMER), A., i, 837.
- Trimesitylarsenic compounds (MICHAELIS and OBERG), A., i, 524.
- 3':4':5'-Trimethoxy-2:4-diethoxybenzoyl-acetophenone (v. KOSTANECKI and PLATTNER), A., i, 690.
- 2:4:6-Trimethoxydiphenyltriketone phenylhydrazone (v. KOSTANECKI and TAMBOR), A., i, 471.
- 2:4:6-Trimethoxy-2'-ethoxybenzoyl-acetophenone phenylhydrazone (v. KOSTANECKI and TAMBOR), A., i, 471.
- 3:3':5'-Trimethoxyflavone (v. KOSTANECKI and WEINSTOCK), A., i, 817.
- 3:7:10-Trimethylacridinium salts, 2:8-diamino-, and its diacetyl derivative (ULLMANN and MARIĆ), A., i, 182.
- 5-(or 3)-Trimethylaminophenylpyrazole dimethiodide (BUCHNER and HACHUMIAN), A., i, 237.
- p*-Trimethylarsenibenzobetaine and its salts (MICHAELIS and EPPENSTEIN), A., i, 414.
- 1:4:6-Trimethylbenzimidazole and its salts (FISCHER, RIGAUD, and KOPF), A., i, 189.

- Trimethylbenzimidazoles, 1:2:5- and 1:2:6-, and their salts (FISCHER and RIGAUD), A., i, 399.
- 2:4:5-Trimethylbenzylideneazine, reduction of, and preparation of some derivatives of the reduction products (HARDING), A., i, 127.
- 2:4:5-Trimethylbenzylidenebenzylidenehydrazine (CURTIUS and FRANZEN), A., i, 832.
- 2:4:5-Trimethylbenzylidenehydrazine and its picrate (CURTIUS and FRANZEN), A., i, 831.
- Trimethylbrazilin, constitution of (v. KOSTANECKI and LAMPE), A., i, 481. oxidation of, with chromic acid (PERKIN), T., 1016; P., 1902, 147; (GILBODY and PERKIN), T., 1040; P., 1899, 27; 1900, 105.
- Trimethylbrazilone (PERKIN), T., 1017; P., 1902, 147; (GILBODY and PERKIN), T., 1040; P., 1899, 27; 1900, 105; (v. KOSTANECKI and LAMPE), A., i, 481.
- $\beta$ -Trimethylbrazilone (v. KOSTANECKI and LAMPE), A., i, 481; (HERZIG and POLLAK), A., i, 483.
- $\gamma$ -Trimethylbutyrobetaine and its salts (WILLSTÄTTER), A., i, 268.
- Trimethylcatechone (v. KOSTANECKI and TAMBOR), A., i, 553. formula of, and its nitro-derivative (KARNOWSKI and TAMBOR), A., i, 637.
- Trimethyldehydrobrazilin, and its acetyl derivative (HERZIG and POLLAK), A., i, 483.
- Trimethyldehydrobrazilone and its acetyl derivative (v. KOSTANECKI and LAMPE), A., i, 481.
- 3:5:5-Trimethyl- $\Delta^{2,6}$ -dihydrocatechol and its dioxime (WOLFF, GABLER, and HEYL), A., i, 676.
- Trimethyldicyclododecatriene (DOEBNER), A., i, 599.
- cyclo*Trimethylene (cyclopropane), 1:2:3-tricyano-, and its -tricarboxylic acid (ERRERA and PERCIABOSCO), A., i, 116.
- Trimethylenecarbinol and its derivatives (DALLE), A., i, 525.
- cyclo*Trimethylenecarboxylic acid and its isobutyl ester, chloride, and amide (DALLE), A., i, 526.
- Trimethylenedisulphonanilides (AUTENRIETH and RUDOLPH), A., i, 22.
- Trimethylenemethane, amino-, and its hydrochloride and platinichloride (DALLE), A., i, 525.
- cyclo*Trimethylenetetra-carboxylic acid, and its dicyano-derivative, ethyl ester (ERRERA and PERCIABOSCO), A., i, 116.
- Trimethylenetriethyltri-amine and its hydriodides and methiodide (EINHORN and PRETNER), A., i, 840.
- Trimethylenexylylenedipiperidylum bromides and salts of the *o*- and *p*-compounds (SCHOLTZ), A., i, 836.
- Trimethylethylene. See Amylene ( $\beta$ -methyl- $\beta$ -butylene).
- 2:2:4-Trimethylhexahydrobenzylaniline (FARBWERKE VORM. MEISTER, LUCIUS, & BRÜNING), A., i, 90.
- 2:4:4-Trimethylcyclohexanol (WALLACH and SCHEUNERT), A., i, 724, 805.
- 2:4:4-Trimethylcyclohexanone and its oximes and semicarbazone (WALLACH and SCHEUNERT), A., i, 724, 805; (WALLACH and FRANKE), A., i, 806.
- 3:5:5-Trimethylcyclohexanone (WALLACH and FRANKE), A., i, 806.
- 2:4:4-Trimethylcyclo- $\Delta^2$ -hexenone and its oxime, semicarbazone and benzylidene derivative (WALLACH and SCHEUNERT), A., i, 724, 805.
- Trimethylhydrindonium hydroxide, resolution of, into its optically active components (KIPPING), T., 275; P., 1902, 33.
- 1:2:5-Trimethylindole (FARBENFABRIKEN VORM. F. BAYER & CO.), A., i, 493.
- Trimethylitamic acid, diethyl ester and silver and sodium salts (NOYES and PATTERSON), A., i, 742.
- Trimethylmalic acid,  $\beta$ -lactone of (KOMPA), A., i, 204.
- Trimethyl- $\beta$ -naphthylammonium iodide (REYCHLER), A., i, 757.
- 2:3:4-Trimethylnicotinic acid (WOLFF, GABLER, and HEYL), A., i, 677.
- 4-Trimethylolmethylpyridine-3-carboxylic acid, lactone of, and its salts and acetyl derivative (KOENIGS), A., i, 180.
- 2-Trimethylolmethylquinoline-3-carboxylic acid, lactone of, and its salts (KOENIGS and STOCKHAUSEN), A., i, 179.
- Trimethylparaconic acid, and its ethyl ester, synthesis of (NOYES and PATTERSON), A., i, 741.
- Trimethylpentane- $\beta\epsilon$ -olidoic acids,  $\beta\gamma\gamma$ - and  $\gamma\gamma\delta$ - (BALBIANO), A., i, 741.
- Trimethylpentanolic acid (MICHEL and SPITZAUER), A., i, 257.
- 4:5:5-Trimethylcyclopentanone, and its oxime, semicarbazone, and benzylidene derivative (BLAISE and BLANC), A., i, 300.
- 2:2:3-Trimethylcyclopentanoneoxime (NOYES and PATTERSON), A., i, 590.
- Trimethylpiperidine (b. p. 166°) and its derivatives (WALLACH and GILBERT), A., i, 80.



- $\beta$ -Trimethylpropionbetaine** and its salts (WILLSTÄTTER), A., i, 268.
- 3:4:5-Trimethylpyrazole** and its 1-carboxylamide (POSNER), A., i, 83.
- 3:5:5-Trimethylpyrazoline** from dimethylketazine (FREY and HOFMANN), A., i, 60.
- 2:4:6-Trimethylpyridine** from Scottish shale oil (GARRETT and SMYTHE), T., 451; P., 1900, 190; 1902, 47.
- 1:2:5-Trimethylpyrrolidine** and its salts (KNORR and RABE), A., i, 54.
- Trimethylpyrrolines**, 1:2:4- and 1:2:5-, and their salts (KNORR and RABE), A., i, 54.
- 2:3:4-Trimethylquinolide** and its additive salts, methiodide, and pseudo-ammonium base (WOLFF, GABLER, and HEYL), A., i, 676.
- 3:3:4-Trimethyl-2-quinoline** (CAMPS), A., i, 178.
- 2:3:4-Trimethylquinolinic acid** and its salts (WOLFF, GABLER, and HEYL), A., i, 677.
- Trimethylsuccinic acid** (*pentanedicarboxylic acid*), bromination of (BONE and SPRANKLING), T., 50; P., 1901, 243.
- Trimethylsuccinic acid** (*pentanedicarboxylic acid*), bromo-, ethyl ester, action of, on ethyl sodiocyanoacetate (BONE and SPRANKLING), T., 52; P., 1901, 243.
- Trimethylsuccinic anhydride**, bromo- (BONE and SPRANKLING), T., 51; P., 1901, 243.
- 2:2:4-Trimethyl-tetra- and -hexa-hydrobenzaldehyde** (FARBWERKE VORM. MEISTER, LUCIUS, & BRÜNING), A., i, 102.
- 1:3:4-Trimethyluracil**, constitution of (BEHREND and THURM), A., i, 832.
- 1:3:8-Trimethylxanthine** (BOEHRINGER & SÖHNE), A., i, 125.
- 3:7:8-Trimethylxanthine** (BOEHRINGER & SÖHNE), A., i, 504.
- Tri- $\alpha$ - and - $\beta$ -naphthylarsenic compounds** (MICHAELIS and BÜSCHLER), A., i, 524.
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# ERRATA.

## COLLECTIVE INDEX, 1883—1892.

for "Tolylacetylene" read "Tolyethylene."

## VOL. LXVIII (ABSTR., 1895).

### PART II.

Page Line

504 15\* for "Sylvanite" read "Sylvite."

## VOL. LXXVIII (ABSTR., 1900).

### PART II.

411 15\* ,, " $(\text{MgOH})_2(\text{K}, \text{Na}, \text{Li})\text{Si}_3\text{O}_8 + \text{H}_2\text{O}$ " read " $(\text{MgOH})_2(\text{K}, \text{Na}, \text{Li})\text{Si}_3\text{O}_8 + \text{H}_2\text{O}$ ."

## VOL. LXXX (ABSTR., 1901).

### PART I.

119 4\* ,, " $\beta\beta\gamma$ -trimethylpentane- $\alpha\gamma$ -olidoic acid" read " $\gamma\gamma\delta$ -trimethylpentane- $\beta\epsilon$ -olidoic acid."

248 22\* ,, "WILLY MARKWALD" read "WILHELM MARCKWALD."

648 5 ,, " $[\text{OH} = 4:6:2':4']$ ," read " $[(\text{OH})_4 = 5:7:2:4]$ ."

,, 7 ,, " $[\text{OH} = 4:2':4']$ ," read " $[(\text{OH})_3 = 5:2':4']$ ."

### PART II.

229 21\*  
766 { 3\* col. i } for "Willy Markwald" read "Wilhelm Marckwald."  
top ,, ii

451 5\* for " $5.653^\circ$ " read " $5.653$ ."

451 4\* ,, " $4.41^\circ$ " read " $4.41$ ."

## VOL. LXXXII (ABSTR., 1902).

### PART I.

6 bottom ,, " $\gamma$ -Methyl- $\alpha$ -isobutylvaleric acid" read " $\beta\gamma$ -Dimethyl- $\alpha$ -isobutylvaleric acid."

52 4\* & 7\* ,, "Dielytra" read "Dielytra."

51 { 11\* } ,, "this vol., i, 604, 643" read "Abstr., 1901, i, 604, 643."  
10\*

86 20 ,, "1901, i, 795," read "1901, ii, 705."

283 10\* ,, "Tetrabromohydroxytoluketone" read "Tetrachlorobromohydroxytoluketone."

299 20 ,, "Dibenzoyl- $\beta$ -alizarin" read "Dibenzoyl- $\beta$ -aminoalizarin."

491 10\* ,, "1-Pyrrylurethane" read "2-Pyrrylurethane."

492 { 1 } ,, "Indole-1-carboxylic" read "Indole-2-carboxylic."  
5 }

492 8 ,, "1-Indole-urethane" read "2-Indoleurethane."

616 22 ,, " $\alpha\beta$ -dibromo- $p$ -ethyl-3:5- $\psi$ -phenol" read " $\alpha$ -3:5-tribromo- $\psi$ - $p$ -ethylphenol."

\* From bottom.

Page	Line	
616	24	for " $\text{OH}\cdot\text{C}_6\text{H}_2\text{Br}\cdot\text{CHMeBr}$ " read " $\text{OH}\cdot\text{C}_6\text{H}_2\text{Br}_2\cdot\text{CHMeBr}$ ."
679	23	„ " $\beta$ -p-glutaranil" read " $\beta$ -p-tolylglutaranil."
727	16*	„ " <i>Davison</i> " read " <i>Davidson</i> ."
741	13, 14	„ " $\beta\gamma\gamma$ -Dimethyl- $\beta$ -hydroxypentanedioic acid" read " $\beta$ -Hydroxy- $\beta\gamma\gamma$ -trimethylpentanedioic acid."
798	10	„ " <i>Benzylidene Cumphor</i> " read " <i>Benzylidenecamphor</i> ."
834	12	} „ " <i>3-Hydroxy-4-methyluracil</i> " read " <i>5-Hydroxy-4-methyluracil</i> ."
„	19*	
„	11*	
„	22*	
„	13*	} „ " <i>3:3:4-trihydroxy-4-methyldihydrouracil</i> " read " <i>4:5:5-trihydroxy-4-methylhydrouracil</i> ."
„	12*	

## PART II.

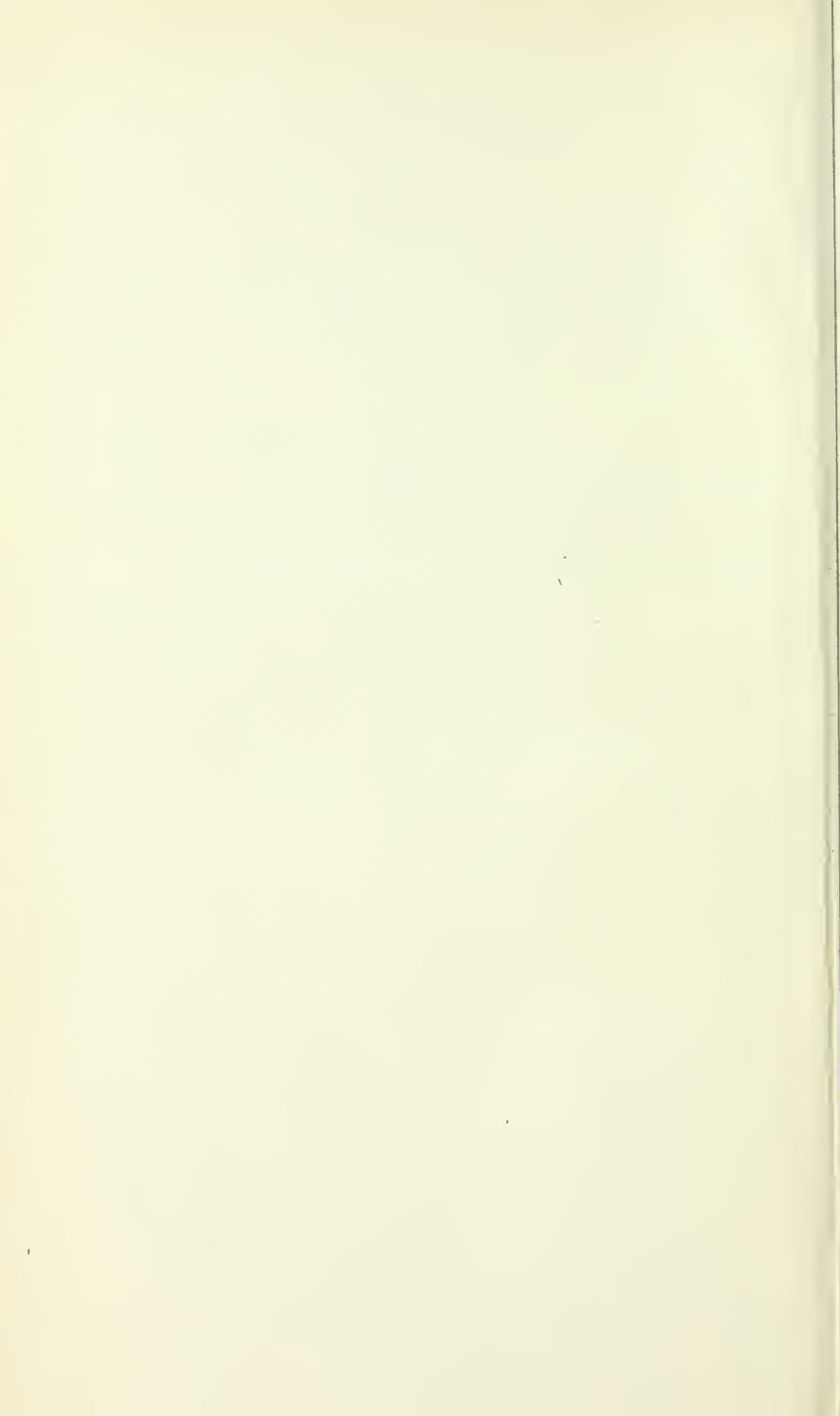
408	17*	} „ " <i>Apophyllite</i> " read " <i>Apophyllite</i> ."
	10*	
	16*	„ " <i>D'ACHIARDI</i> " read " <i>D'ACHIARDI</i> ."
650	17*	„ "depressed from $119\cdot25^\circ$ to $42\cdot5^\circ$ " read "depressed by an amount corresponding with the atomic depression $42\cdot5^\circ$ ."
„	14*	„ "sealed" read "open."
„	7* to 4*	<i>delete</i> "The substances, with the exception of carbon dioxide, which have the latter action will also reduce the amount of any amorphous sulphur formed."

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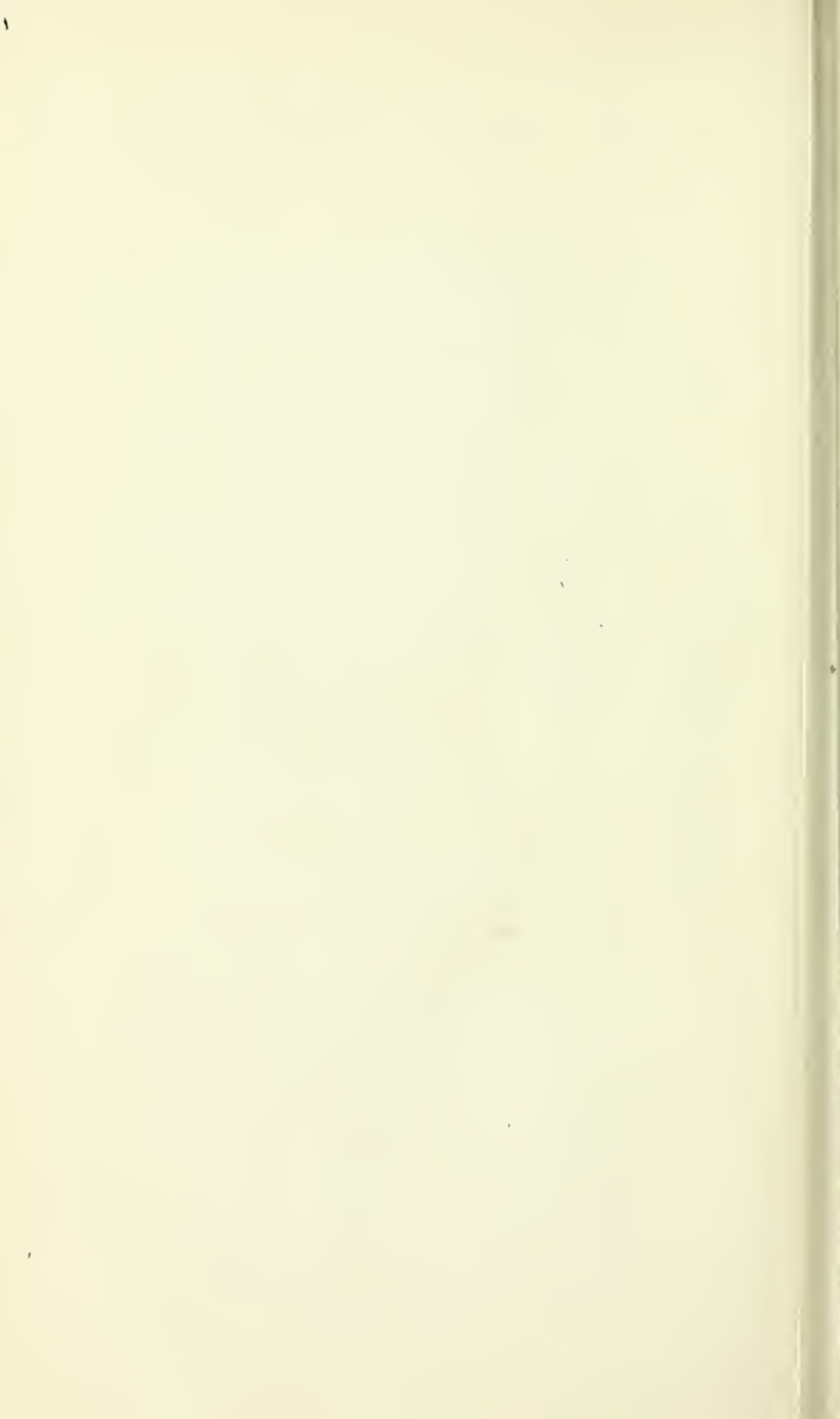
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